

In celebration of the 80th birthday of Zdeněk Bouček: Father of modern Chalcidoidea systematics

I first met Zdeněk in October 1974 when I joined the Entomology Department of the British Museum (Natural History) (now the Natural History Museum) as a new staff member. I was immediately impressed by his knowledge of Hymenoptera in general and, of course, chalcidoids in particular. At that time I did not really have an idea what chalcidoids were, except that the group included the smallest parasitic Hymenoptera and had a reputation for being amongst the most difficult to study taxonomically. Zdeněk must have wondered what had hit him as he had been given the task of being my mentor on the subject and getting me up to speed as a chalcidoid taxonomist. He was extremely patient with my endless questions regarding collecting, specimen preparation (which I found particularly difficult), drawing and identification. I was, and still am, in total awe of his understanding of chalcidoid systematics and taxon recognition. This is echoed by the world's Chalcidoidea systematics community, most of whom have benefitted from Zdeněk's incredible patience and knowledge when starting out on studying their respective groups. However, initial contacts were not always easy. Many chalcidologists will remember a surprisingly cool response to initial requests for loans of material or help in their work, little knowing that he had been working on THAT particular group for years and had a manuscript almost ready for publication. Of course, the best of these would eventually impress Zdeněk and he would give them virtually limitless help and ultimately would let them into all, or virtually all his secrets concerning the particular group in question. In many cases this included manuscript keys to taxa and his notes on type material. Although somewhat reluctant to apply modern phylogenetic methods to classification and other modern techniques to taxonomy, it can be said that his influence on the systematic study of Chalcidoidea has been profound. Without him we might still be languishing in the equivalent of 1920's taxonomy. Apart from his prowess as a systematist, Zdeněk has a marvellous sense of humour and has the ability to enthrall listeners with accounts of various collecting expeditions and of a tough life under a communist regime. Many of us can well remember his tremendous energy, particularly when it came to discussing the benefit of phylogenetic methods (generally as an antagonist) and even to the extent of impressing us with a bout of Cossack dancing only a few years ago.

Zdeněk Rudolf Jan Bouček was born in Hradec Králové in the Czech Republic on January 8th 1924. He was the son of Václav and Anna Bouček who ran a farm near the town. He also had two younger sisters. After the end of the second world war he attended the Natural History Faculty of Charles University in Prague where he obtained his RNDr in June 1949. After a short period of



Zdeněk Bouček in his lab in the Natural History Museum of London (ca 1982).

temporary employment in the Parasitological Department of the university he spent two years (1949–1951) in national service with the Czech army. In December 1949 Zdeněk married Tatiana (Tania) Rydlová, the niece of a local amateur entomologist in Hradec Králové. Their daughter, Jitka, was born the following year. On leaving the army he took up employment with the Plant Protection Department of the Research Institute for Crop Production in Praha-Ruzyne where he worked until 1960. In that year he joined the staff of the Natural History Museum that was located in the centre of Prague, but eventually he moved, with the entomological collections, to a new location at Kunratice on the outskirts of the city. He was awarded the degree of Doctor of Biological Sciences (Dr Sc.) in 1969 by the Czechoslovak Academy of Sciences on the basis of his dissertation, a taxonomic revision of the European Chalcididae, which had been published earlier [5].

Zdeněk never strayed from the goals that he had set himself. His perseverance, industry and tenacity of purpose helped him to overcome the severe constraints imposed by the political regime in Czechoslovakia at that time. He was not allowed to visit the important collections in western Europe and contact with other specialists was very difficult if not impossible. In 1969, as a result of the deteriorating political situation in Czechoslovakia, Zdeněk took the painful decision to emigrate with his family to England. He was helped in this by his good friend Eric Classey who flew to meet him in Turin when Zdeněk was on a rare visit outside communist Europe. A letter was smuggled to Tania in Prague in which they suggested that she join them in Turin. Fortunately the Czech authorities did not realise at the time that their daughter Jitka was also out of the country on a study holiday in England. If the authorities had known this to be the case it is doubtful that Tania would have been allowed to leave Czechoslovakia. As a result, Tania travelled to Turin by car, carrying with her much of Zdeněk's literature. She was allowed to cross the border out of Czechoslovakia only because she had a letter of support from the Natural History Museum saying that the literature was essential for him to complete his work in Turin. From there they decided to travel to England. On arrival in England in September of that year, Eric Classey helped Zdeněk and Tania through immigration formalities as their passports had nearly expired. Eric also helped to extend Jitka's visa which had run out by that time.

In January 1970, again with the help of Eric Classey and another friend, Marcus de V. Graham, Zdeněk was able to obtain a temporary position for about 6 months in the Hope Department at Oxford University. During this period he was offered very lucrative positions in the USA and Germany. Money was not important to Zdeněk and he turned down these offers in favour of a position in London because of the better facilities and collection there. In June of that year he took up full employment as a taxonomist with the Commonwealth Institute of Entomology which was housed in the British Museum (Natural History) in London, and where he worked until his full



Zdeněk Bouček (right) with his wife Tania and Petr Janšta in Bouček's house in Velký Vřešťov (2004).

retirement in 1989. During that time Zdeněk was fully committed to his family and to working in London. He and Tania visited Australia twice, once for four months in 1976–1977 and once for four months 1982–1983. Although offered a very favourable full-time position with CSIRO in Canberra Australia in 1983 he decided to remain in London to continue his work.

After retirement Zdeněk and Tania spent six months in Ottawa where Zdeněk helped organise the Chalcidoidea housed in Canadian National Collection of insects. The following year (1990) they lived for 12 months in France where Zdeněk worked with Jean-Yves Rasplus on an illustrated key to West-Palaearctic genera of Pteromalidae [153].

With the fall of the “Berlin wall” in 1989 and “velvet revolution” in Prague later that year, Zdeněk and Tania returned to their homeland once again and, in 1992, bought a cottage in Velký Vřešt'ov where they now spend most of the year.

Zdeněk is an avid collector of Hymenoptera, a task frequently aided by Tania. Together they have been on many trips to Europe, North America and Australia. Over the years he has built up an impressive collection of Chalcidoidea and other Hymenoptera. A proportion of this, mostly Encyrtidae and non-European material, has been deposited in the Natural History Museum, London but the bulk of it, mostly non-Encyrtidae and European material, remains in Czech Republic, in the care of the National Museum (Natural History), Prague. Age has unfortunately slowed Zdeněk in his work, but in recent years he has encouraged a Czech student, Petr Janšta, to continue work on the group and to care for his collection of literature and the part of his collection that is in Charles University.

Zdeněk's publications on Chalcidoidea began with his revision of the European species of the family Chalcididae [5], and continued with works on the European species of the Perilampidae [14, 16, 63, 67], Tetracampidae [22], Pteromalidae [3, 9, 10, 16, 19, 21, 43, 44, 52, 55, 57, 58, 60, 66, 68, 78, 113, 157] and Eulophidae [28, 29, 37, 41, 46, 56, 65, 79, 119, 131, 142], on world species of Leucospidae [74] and Torymidae [84, 98, 118, 119, 121, 125, 149]. His professional work culminated in a superb monograph of more than 800 pages in 14 families of Australasian Chalcidoidea [109]. This latter work included such a large number of new taxonomic and nomenclatural changes that it reportedly took one person more than three weeks to extract the relevant information for inclusion in *Zoological Record*. It has been acknowledged as the fundamental and indispensable work for everyone wishing to work with the group of insects. After earlier works, mainly on *Spalangia* [40], and a catalogue of Palaearctic Eulophidae [131], African Torymidae [91], European and Indian Pteromalidae [133, 160], European Eulophidae, Mongolian Perilampidae [101] and especially West-Palaearctic genera of Pteromalidae [157], he completed keys to the North American genera of Pteromalidae [144] and several other families [122, 123, 124, 143]. His chalcidological contributions also included species important in the biological control of pests [e.g. 94, 95, 155]. His extensive activity has resulted in more than 150 publications. He has also published works on the Palaearctic species of *Ammoplanus* (Sphecidae) [126, 127]. For the former Czechoslovakia, he edited and wrote the major part of keys to the genera and partly the species of Hymenoptera [129]. In the sixties these keys were widely used, not only in Europe but also elsewhere, especially the part on the Chalcidoidea (translated into English) [170]. Zdeněk has also done much for the faunistics of the former Yugoslavia [90] and the present Czech and Slovak Republics. The results of the latter research are included in the check list of Czechoslovakian insects III (Hymenoptera) in which, as an emigrant, he could not be mentioned as co-author of the part on the Chalcidoidea. In addition, he has done a lot of useful work and provided friendly help in the identification of chalcidoids as parasitoids of economically important pests, and in providing literature for various individuals and organizations at home and abroad.

In summary, in addition to eight species of Sphecidae and one genus and one species of Braconidae, Zdeněk has described 1094 taxa in Chalcidoidea as follows:

47 family group names [Chalcididae 3 tribes; Eucharitidae 1 subfamily; Eupelmidae 2 subfamilies; Eulophidae 3 tribes; Eurytomidae 1 subfamily, 2 tribes; Pteromalidae 15 subfamilies, 14 tribes; Rotoitidae – family; Tetracampidae 1 subfamily, 4 tribes]

281 genus group names [Agaonidae 7 genera; Chalcididae 11 genera; Encyrtidae 2 genera; Eucharitidae 8 genera, 2 subgenera; Eulophidae 43 genera, 3 subgenera; Eupelmidae 5 genera, 3 subgenera; Eurytomidae 12 genera; Leucospidae 1 genus; Ormyridae 1 genus; Perilampidae 2 genera; Pteromalidae 158 genera, 4 subgenera; Rotoitidae 1 genus; Tetracampidae 2 genera; Torymidae 15 genera, 1 subgenus]

766 species group names [Agaonidae 18 species; Chalcididae 84 species, 3 subspecies; Encyrtidae 4 species; Eucharitidae 11 species; Eulophidae 149 species, 1 subspecies; Eupelmidae 17 species; Eurytomidae 25 species; Leucospidae 46 species; Ormyridae 5 species; Perilampidae 38 species; Pteromalidae 272 species, 1 subspecies; Rotoitidae 1 species; Tanaostigmatidae 1 species; Tetracampidae 13 species; Torymidae 76 species, 1 subspecies]

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(In alphabetical author order, then chronological order)

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Observations on the biology of *Baryscapus* (Hymenoptera: Eulophidae: Tetrastichinae) with description of a new koinobiont hyperparasitoid with delayed development

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Abstract. What is known of the developmental biology of the tetrastichine eulophid genus *Baryscapus* Förster, 1856 is reviewed. *Baryscapus bouceki* sp. nov. is described from Tunisia, and its biology as a true koinobiont hyperparasitoid of the pierid butterfly *Euchloe belemia* (Esper, 1800) via the braconid wasp *Microplitis* sp. is discussed. The type series of four females was reared from a *Microplitis* Förster, 1862 cocoon 35 months after its formation. As the *Microplitis* was seen to be still alive 21 months after it had formed its cocoon, with the *Baryscapus.bouceki* sp. nov. still invisibly inside it, the period of koinobiosis practised by this brood of *B. bouceki* sp. nov. was at least 21 and probably closer to 35 months. It is suggested that development of the endoparasitic *B. bouceki* sp. nov. is probably delayed while the *Microplitis* remains in diapause, and that the capacity for prolonged diapause by this desert-inhabiting *Microplitis* species is an adaptation to survive failure of winter rains.

Taxonomy, new species, Hymenoptera, Eulophidae, *Baryscapus*, prolonged koinobiosis, Braconidae, *Microplitis*, drought adaptation, Lepidoptera, *Euchloe belemia*, hyperparasitism

INTRODUCTION

Baryscapus Förster, 1856, as recognized by Graham (1991), is a large genus of Tetrastichinae with about 60 species in Europe and North Africa. Although the biology of only very few of these species is known in any detail, hosts (primary or secondary) are recorded for about three-quarters. These hosts are drawn from Hemiptera, Neuroptera, Coleoptera, Hymenoptera, Lepidoptera and Diptera, and there is much variety in the ways in which they are exploited. Nonetheless, certain generalizations about host relations are possible.

All species develop endophagously and, in larger hosts, gregariously (the erroneous statement that *B. aenescens* Askew, 1997 is an ectoparasitoid (Askew & Blasco-Zumeta 1997) was corrected by Askew & Blasco-Zumeta (2000)). Available information indicates that each species of *Baryscapus* tends to utilize hosts in a more or less specific and restricted situation, but monophagy is rare. Secondary parasitism, sometimes facultative but for some species either obligatory or the preferred mode of development, is common.

Among species for which at least some biological details are recorded, *B. दौरа* (Walker, 1839) is one of a group attacking Tephritidae (Diptera) living in seed heads of Asteraceae. Here it develops as a gregarious endoparasitoid in larvae of both gall forming *Urophora stylata* (Fabricius, 1775) and non-gall forming *Terellia serratulae* (Linné, 1758) in capitula of *Cirsium vulgare* (Redfern 1983: partly as *Tetrastichus cirsii* (Kurdjumov, 1913)) and of gall forming *Urophora jaceana* (Hering, 1935) and non-gall forming *Chaetoriella jaceae* (Robineau-Desvoidy, 1830) in

Centaurea heads (Varley 1947). Considerable diversity in host selection is displayed by *Baryscapus gradwelli* Graham, 1991, another gregarious parasitoid in larvae of *Urophora jaceana*, which is known sometimes to behave as a secondary parasitoid through the chalcidoids *Eurytoma tibialis* Boheman, 1836 (= *E. curta* Walker, 1832, misidentified), *E. robusta* Mayr, 1878, *Pteromalus elevatus* (Walker, 1834) (= *P. trypetae* Thomson, 1878, misidentified) and the ichneumonid *Scambus buolianae* (Hartig, 1838) (Varley 1947: as *Tetrastichus* sp. B).

Although such broad ranges of hosts as exhibited by *Baryscapus gradwelli* are unusual for endoparasitoids unless they are idiobionts (i.e. parasitoids that prevent the hosts' further development at the time of attack), there appears to be more scope for this among koinobiont endoparasitoids when they are behaving as hyperparasitoids through Hymenoptera. Askew & Shaw (1986) noted the relatively broad host ranges of species of *Mesochorus* Gravenhorst, 1829 (Ichneumonidae: Mesochorinae), which are koinobionts and obligatory hyperparasitoids, and raised the still unanswered question whether it indicated that there had been less selection pressure on primary parasitic Hymenoptera than on their host groups to evolve a potent physiological defence system, or whether it suggested some peculiarity of *Mesochorus* that enabled them broadly to overcome such defensive systems. Therefore the wide host range of *B. gradwelli* does not necessarily suggest that it is an idiobiont. In any case, koinobiosis, albeit of perhaps rather short duration, is known in *B. galactopus* (Ratzeburg, 1844) (= *Tetrastichus rapo* auctorum non Walker, 1839). This is an apparently obligatory hyperparasitoid, predominantly of *Cotesia* Cameron, 1891 species (Braconidae) developing in caterpillars of *Artogeia* Verity, 1947, *Pieris* Schrank, 1801, *Pontia* Fabricius, 1807 and *Colias* Fabricius, 1807 (Lepidoptera: Pieridae) but other hosts, primary (*Hyposoter* Förster, 1868 – Hymenoptera: Ichneumonidae) and secondary (*Cerura* Schrank, 1802 – Lepidoptera: Notodontidae), are also recorded. Sometimes the *Cotesia* are attacked after they have left the body of their caterpillar host (pseudohyperparasitism), but more often oviposition is into the braconid larva inside a partly or fully grown caterpillar. Female *Baryscapus galactopus* may discriminate between parasitized and unparasitized caterpillars before insertion of the ovipositor (Martelli 1907, but not Picard 1921). Usually, parasitized braconid larvae soon emerge from their primary host, and are killed only after they have spun cocoons from which adult *B. galactopus* eventually emerge (Martelli 1907, Gautier & Bonnamour 1924, Ferrière & Faure 1925, Clausen 1940).

In summary, *Baryscapus* species are endoparasitoids but often relatively polyphagous. The extent to which the primary host continues to live and develop after parasitization is uncertain in some species whose host associations are otherwise well documented, and some might be either idiobionts or only briefly koinobiotic. However, prolonged koinobiotic development certainly occurs in the new species of *Baryscapus* described below.

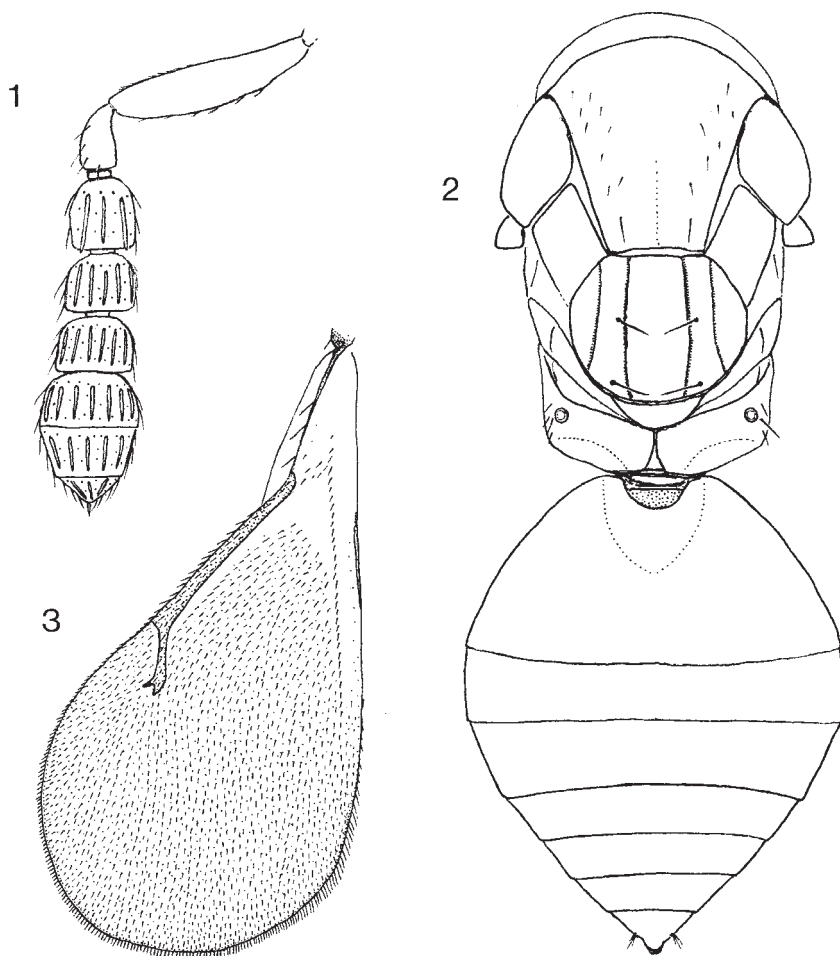
TAXONOMY

Baryscapus bouceki sp. nov.

(Figs 1–3)

DESCRIPTION. Female. Body dark green, slightly bluish, sutures of thoracic dorsum and longitudinal lines of scutellum coppery. Scape dark green, rest of antenna black. Coxae and most of femora concolorous with thorax, apical one-fifth of all femora pale yellow; tibiae brown with tips somewhat paler; tarsi brown, the two basal segments of meso- and metatarsi paler. Tegulae black. Wings clear, venation brownish, an indistinct pale spot between marginal vein and parastigma. Length 1.6–1.7 mm.

Head (collapsed in all available specimens) apparently not quite as broad as mesoscutum; POL 2.7 OOL, OOL almost twice ocellar diameter; malar space 0.6 times height of eye, suture strongly



Figs 1–3. *Baryscapus bouceki* sp. nov., holotype female, 1) antenna, 2) meso- and metasoma in dorsal view, 3) left forewing.

curved. Antenna with scape 0.77 times height of eye; pedicel plus flagellum (Fig. 1) 0.77 times breadth of mesoscutum; pedicel much longer than F1, about twice as long as broad; funicle with F1 much stouter than pedicel and subquadrate, F2 and F3 very slightly transverse, all funicle segments subequal in length; clava distinctly broader than funicle, 1.3–1.4 times as long as broad, longer than F2 plus F3, all segments transverse, apical spine about 0.4 times length of C3; sensillae numerous, in a single transverse row on each segment; pilosity relatively long.

Mesosoma (Fig. 2) 1.45 times as long as broad, 1.15 times as broad as deep. Mesoscutum with mid-lobe about as broad as long; moderately shiny with very fine, engraved reticulation and

median line subobsolete, visible only posteriorly in oblique view; 8–12 adnotaular setae on each side with a broad, bare strip in the middle. Scutellum 1.2 times as broad as long, convex; submedian lines distinctly closer to sublateral lines than to each other, enclosing a space 2.3–2.4 times as long as broad; setae about 0.85 times as long as distance between submedian lines, the anterior pair in front of the middle. Dorsellum about 2.4 times as broad as long. Propodeum medially about 1.3 times as long as dorsellum; shiny with weak, superficial reticulation, the median carina broadening in posterior half so that at posterior margin of propodeum it is rather more than twice as long as broad; spiracle shortly oval, separated from metanotum by about 0.75 times its length; callus with 3–6 setae.

Forewing (Fig. 3) 2.05 times as long as broad; ratio lengths costal cell: marginal vein plus parastigma: stigmal vein as 86:106:35; postmarginal vein rudimentary; submarginal vein with 3–4 dorsal setae and 6–7 ventral setae in basal half, the row of ventral setae continuing on undersurface of membrane in apical half of costal cell; basal vein pilose with a few additional hairs in apical half of basal cell; speculum moderately large, closed below; wing pilosity moderately dense, short, the apical cilia hardly longer than narrowest breadth of stigmal vein. Hindwing rounded at apex.

Gaster (Fig. 2) roundish, 1.1–1.3 times as long as broad, broader than and about as long as mesosoma; ovipositor sheath hardly projecting; hypopygium tip at about 0.3 gaster length.

Male. Unknown.

TYPE MATERIAL. Holotype, ♀: Tunisia, Tataouine near Krachaoua, 240m, one of brood of four ex cocoon of *Microplitis* (Hym., Braconidae) reared from larva of *Euchloe belemia* (Esper) (Lep., Pieridae) collected 11.iv.2000, P. J. C. Russell leg. Deposited in National Museums of Scotland, Edinburgh; Paratypes, 3♀♀, from same brood as holotype. Deposited in the Natural History Museum, London and in Askew's collection.

NAME DERIVATION. Named after Zdeněk Bouček, in recognition of his immense contribution to our knowledge and understanding of Chalcidoidea.

COMMENTS. Assignment of *Baryscapus bouceki* sp. nov. to one of the two species-groups recognized by Graham (1991: 76) is uncertain because the submedian lines of the scutellum are closer to the sublateral lines than to each other (character of *B. दौरa*-group) but enclose a space clearly more than twice as long as broad (*B. evonymellae*-group). The propodeum is medially longer than the dorsellum (*B. दौरa*-group), but the spiracles are separated from the metanotum by about three-quarters of their diameter (*B. evonymellae*-group). Absence of a clearly-defined hyaline spot between marginal vein and parastigma, and the host relations, are indicative of the *B. evonymellae*-group in which *B. bouceki* sp. nov. may be distinguished in Graham's (1991: 77) key by its combination of short gaster, short antennal segments and dark scape and tegula. *B. bouceki* sp. nov. differs from all species included in Graham's (1991: 142) key to the *B. दौरa*-group by the relatively elongated space between the submedian scutellar lines together with its short gaster and three or more dorsal setae on the submarginal vein.

BIOLOGY. A larva of *Euchloe belemia* (Esper, 1800), the secondary host of *Baryscapus bouceki* sp. nov., was collected in April 2000 and eight days later produced a larva of *Microplitis* sp., the primary host, which immediately spun an extremely tough cocoon. This was sent to MRS soon after and stored in a corked tube in an outdoor shed. Nothing having emerged 21 months later, the cocoon was opened on 10.i.2002 and found to contain a living *Microplitis* Förster, 1862 pupa which was not coloured-up. This, still in its partly opened cocoon, was placed in a small gelatine capsule and returned to the shed. When next examined, on 2.iii.2003, four active chalcidoid larvae were seen. These were then kept indoors and each produced an adult *B. bouceki* sp. nov. on 24.iii.2003, 35 months after the secondary host had been collected.

The *Microplitis* assumed to have been parasitized by *B. bouceki* sp. nov. in the field, when itself developing in the *Euchloe belemia* caterpillar. It is highly improbable that *B. bouceki* sp. nov.

attacked the captive *Microplitis* cocoon. Thus, *B. bouceki* sp. nov. is a true hyperparasitoid and koinobiont, presumably ovipositing in the larva of its braconid primary host but not killing the latter until after it had pupated. Koinobiosis lasted at least 21 and probably nearer 35 months. It seems probable that *B. bouceki* sp. nov. remains as a first instar larva inside the *Microplitis* larva until its further development is triggered by hormonal events when the *Microplitis* pupates.

The *Microplitis* primary parasitoid of *Euchloe belemia* is apparently adapted to a desert environment, overwintering in a tough, drought-resistant cocoon. There is evidence that development of overwintered *Microplitis* cocoons is triggered by dampness, and delayed development would be of survival value to a desert-adapted species when winter rains fail. It would be similarly advantageous for *B. bouceki* sp. nov. to be developmentally synchronized with the *Microplitis* population.

Baryscapus aenescens Askew, 1997, a gregarious endoparasitoid of the phytophagous *Blascoa ephedrae* Askew, 1997 (Hymenoptera: Pteromalidae) in seeds of *Ephedra* (Askew & Blasco-Zumeta 1997, 2000), is a primary parasitoid but, like *B. bouceki* sp. nov., it inhabits a very dry environment (the steppe-like Monegros of eastern Spain) and adult emergence may be delayed. Up to eight winters can be passed in an immature state, although emergence of adults is staggered and some appear after just one winter. The host, *Blascoa ephedrae*, also has a staggered emergence, interpreted as a means of enabling the species to survive years in which *Ephedra* seed-production fails because of drought.

Acknowledgements

We are grateful to P. J. C. Russell who sent MRS the material on which this study is based.

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***Cyphacolus bouceki* sp. nov. (Hymenoptera: Scelionidae) from Australia with a discussion of generic relationships within the Baeni**

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Abstract. The genus *Cyphacolus* Priesner, 1951 is unusual among members of the Baeni in having elytraform fore wings and lacking fore wing venation. It is closely allied to *Odontacolus* Kieffer, 1910 based on the laterally compressed metasomal horn and pedunculate metasoma and may render this genus paraphyletic. Previously known only from the type species, *C. veniprivus* Priesner, 1951 from Egypt, *Cyphacolus* is now recorded by several rarely collected species from the Afrotropical, Oriental and Australian regions. Here we describe the most common species from Australia, *Cyphacolus bouceki* sp. nov., which may have a disjunct wet forest distribution between north and south-east Queensland. In addition, we transfer *Tetrabaeus bhowaliensis* Mani et Mukerjee, 1976 to *Cyphacolus* (comb. nov.), it being previously misplaced in the Platygastriidae, and we discuss the relationships of *Cyphacolus* within the Baeni, an extremely diverse tribe whose members are endoparasitoids of spider eggs.

Taxonomy, new species, new combination, Hymenoptera, Scelionidae, Baeni, *Ceratobaeus*, *Cyphacolus*, *Idris*, *Odontacolus*, Australian region

INTRODUCTION

The genus *Cyphacolus* was erected by Priesner (1951) for a single female, described as *C. veniprivus*, 1951, collected in Cairo in 1937. Priesner postulated that the genus was related to *Ceratobaeus* Ashmead 1893 and *Odontacolus* Kieffer 1910 based on the presence of a metasomal horn, but that it could be distinguished from them by the absence of fore wing venation and having a dark infusate patch in the fore wing. He further indicated that *Cyphacolus* and *Odontacolus* were more closely related to each other based on their more transverse scutellum and having a „distinctly developed propodeum,“ a statement that presumably refers to the pair of large spine-like flanges that flank the metasomal horn. Since Priesner (1951), the genus has virtually been ignored except for taxonomic citations (Muesebeck & Walkley 1956, Johnson 1992), although Kozlov (1971) included *Cyphacolus* in a key to genera, and Iqbal & Austin (2000) included a single undescribed species in their phylogenetic analysis of the Baeni.

Over the past 20 years, a number of new species of *Cyphacolus* have been collected using yellow pan and Malaise traps, although most are represented by very few specimens. This material is mostly held in three collections; the Canadian National Collection, Ottawa, the Australian National Insect Collection, Canberra, and the Department of Primary Industries Collection, Brisbane, and it extends the known distribution of the genus to include the Afrotropical, Oriental, Australian regions, as well as the North African part of the Palaearctic. Our aim here is to describe the most common species from Australia, *Cyphacolus bouceki* sp. nov., that may have a disjunct wet forest distribution between north and south-east Queensland. In so doing, we also honour and celebrate

the 80th birthday of our colleague Zdeněk Bouček. In addition, we transfer *C. bhowaliensis* (Mani et Mukerjee, 1976) (comb. nov.) to *Cyphacolus*, which was previously misplaced in platygastrid genus *Tetrabaeus* Kieffer, 1912, and discuss the relationships of the genus within the Baeini.

MATERIALS AND METHODS

Specimens for SEM were sputter-coated with 6nm of palladium using a Cressington 208HR Sputter Coater, and examined using a Philips XL30 field emission SEM. Figures 1 and 2 were photographed through a Leica M16 stereomicroscope using a Nikon DXM1200 digital camera and AutoMontage (4.02) software.

Morphological terms follow Masner (1980) and Galloway & Austin (1984). Abbreviation for collections are as follows: Australian National Insect Collection, Canberra (ANIC); Canadian National Collection, Ottawa (CNCI), The Natural History Museum, London (BMNH); Department of Primary Industries Collection, Brisbane (QDPC); United States National Museum of Natural History, Washington, D.C. (USNM); Waite Insect and Nematode Collection, The University of Adelaide, Adelaide (WINC).

TAXONOMY

Cyphacolus Priesner, 1951

Cyphacolus Priesner, 1951: 123 (type species: *Cyphacolus veniprivus* Priesner, 1951, by original designation); Muesebeck & Walkley, 1956: 345; Kozlov 1971: 36; Johnson 1992: 366.

DIAGNOSIS. Body often largely appearing smooth and shiny, often with dichromatic markings; head in anterior view suboval or subtriangular, not elongate in buccal region; female antenna 7-segment, clava large and unsegmented or with indistinct suture lines; male antenna short, 11-segmented but appearing to be 10-segmented as last two funicle segments are closely joined, distal funicle segments becoming progressively broader so that antenna is almost subclavate; notauli usually present as distinct grooves reaching no more than about half way to anterior margin of scutum, sometimes notauli hidden by coarse longitudinal sculpturing; scutellum usually flat and subrectangular, with posterior margin usually straight in middle part; propodeum with pair of broad, elongate spines which are blunt or truncate apically; fore wings macropterous, never brachypterous, narrow basally with transverse fold about one-third distance from body, broad in apical half, elytraform in that wing surface is sinuate, convex in apical part and moulded to dorsal surface of metasoma; fore wing venation lacking except submarginal vein, pronounced infusate patch at position of marginal and stigmal veins and sometimes elsewhere; metasoma pedunculate in dorsal view, in lateral view dorsal surface slightly to strongly convex; first tergite with large horn-like process which is laterally compressed (i.e. ellipsoidal in cross-section); third tergite slightly longer than second tergite, sometimes subequal in length.

COMMENTS. Here we transfer *Tetrabaeus bhowaliensis* Mani et Mukerjee, 1976 to *Cyphacolus* (comb. nov.). Although we have not seen the holotype (in the USNM), the figures presented in Mani & Mukerjee (1976) clearly show the structure and form of the fore wing, female antenna and metasoma, which concur exactly to the diagnosis above. This species was misplaced in *Tetrabaeus* which is a member of the Platygastridae (Masner & Huggert 1989) and differs completely from *Cyphacolus*, for example in having percurrent notauli, lacking a metasomal horn and propodeal spines, having T2 the largest metasomal tergite, densely pilose metapleuron and lateral T1, and having typical 'Inostemamatine' fore wing venation (Masner & Huggert 1989). Although the figures presented by Mani & Mukerjee (1976) are reasonably accurate, their description of *C. bhowaliensis* is lacking in many respects; for example they apparently could not discern the suture between the second and third tergites and assumed them to be a single (second) segment.

The above diagnosis is based on the three described species, *C. bhowaliensis*, *C. bouceki* sp. nov. and *C. veniprivus*, as well as a number of undescribed taxa from Africa (Ivory Coast, Nigeria,



Figs 1, 2. Habitus view of female paratype of *Cyphacolus bouceki* sp. nov., 1 dorsal view, 2 lateral view. Specimen length 1.1 mm.

Zimbabwe: BMNH, CNCI), Pakistan (BMNH) and Australia (ANIC, CNCI). The location of the holotype of *C. veniprivus* is unknown, but two specimens in CNCI match this taxon very closely and we have used them to assess characters for the key below. The genus will key to *Odontacolus* in Galloway & Austin (1984) and Masner (1976, 1980), but can be separated from this genus by the shape and venation of the fore wing.

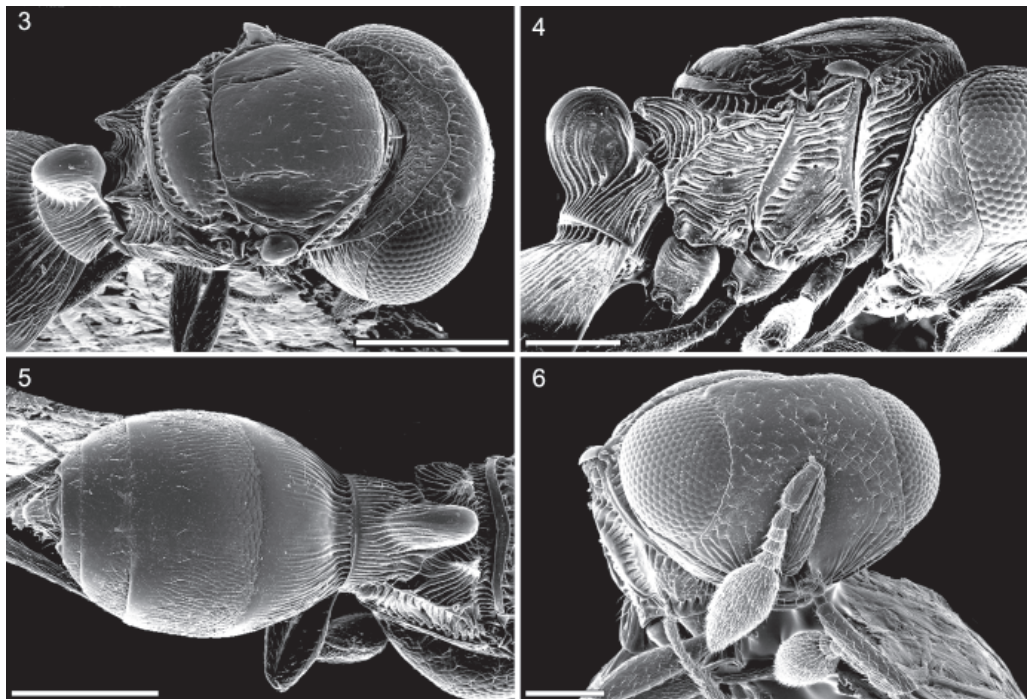
One Australian species has recently been reared from an unknown spider's egg sac, thus confirming that the host relationships of the genus match that for the tribe in general (Austin 1984, 1985, Austin & Field 1997).

RELATIONSHIPS. *Cyphacolus* + *Odontacolus* clearly form a monophyletic group within the Baeini, based on the shape of the metasomal horn, the presence of a pair of large blunt spines on the propodeum, and having a pedunculate metasoma. A metasomal horn occurs widely among platygastroid genera (Masner 1976, Masner & Huggert 1989, Austin & Field 1997) but only in *Cyphacolus* and *Odontacolus* is it ellipsoidal in cross-section. This shape is apparently linked to the functional mechanics of the ovipositor system as the ovipositor is retracted within the metasoma and is curled around in the curved head of the metasomal horn so that it forms an elongated, bent U-shape (Austin 1983). A similar arrangement is also known in the platygastroid genus *Synopeus* Foerster, 1856 (*Sactogaster* Foerster, 1856) but in this group the ovipositor is coiled within a ventral expansion of sternite 2.

Less clear is how the species of *Cyphacolus* and *Odontacolus* are related to each other. It is likely that *Cyphacolus* is monophyletic given the unique shape and venation of the fore wing. However, there are no synapomorphies for *Odontacolus*, and *Cyphacolus* may very well represent

a species group within it as indicated by the preliminary phylogenetic analysis of Iqbal and Austin (2000a). Previously, a defining character of *Odontacolus* was thought to be the elongate, conical shape to the buccal region of the head, compared with the more plesiomorphic oval or triangular shape of *Cyphacolus*, *Ceratobaeus* and other baeine genera. However, this unusual elongate shape is now known not to be universal for *Odontacolus* spp., in that several species have a triangular lower face (material in ANIC, CNCI), while an elongate, conical buccal region is now known to occur in *Ceratobaeus* from Australia (Iqbal & Austin 2000b) and Africa (material in CNCI), albeit only rarely. The importance of these characters in defining monophyletic units or otherwise will only become apparent when a more comprehensive analysis is undertaken of *Cyphacolus* and *Odontacolus* spp. on a worldwide basis.

More problematic is the position of *Cyphacolus* and *Odontacolus* within the Baeini. This is an extremely diverse tribe of scelionids with uncertain relationships, whose members are all endoparasitoids of spider eggs (Austin 1984, 1985). The preliminary analysis of Iqbal & Austin (2000a) employing 35 morphological characters, places these two genera within a basal clade along with *Hickmanella* Austin, 1981 and several undescribed species of *Idris* Foerster, 1856 and *Ceratobaeus*. However, the results of this analysis lacked stability because of the extremely high level of reductional synapomorphies (i.e. character losses) displayed by the Baeini, particularly associated with the reduction of the wings and convergence on the highly fusiform body shape associated with cryptobiotic habits, typified by *Baeus* Haliday, 1833 (Austin et al. 2005). Interestingly, these reductional states do not occur in *Cyphacolus* and *Odontacolus*, and they show no apparent specialisations for searching out host egg



Figs 3–6. SEMs of female paratype of *Cyphacolus bouceki* sp. nov., 3 dorsal view of head, mesosoma and first metasomal tergite (scale = 200 μ m), 4 lateral view of head, mesosoma and first metasomal tergite (scale = 100 μ m), 5 dorsal view of mesosoma (scale = 200 μ m), 6 anterior view of head and antenna (scale = 100 μ m).

sacs in leaf-litter, with possibly one exception, the elytraform-like fore wings of *Cyphacolus*. This character is strongly reminiscent of the situation in the ambositrine diapriid genus *Acanthobetyla* Dodd, 1926, where the elytraform fore wings of the female also lack venation and the wings are deeply infusate (Naumann 1982). This arrangement presumably protects the surface of the fore wings when females are moving through litter, and the same may also apply to members of *Cyphacolus*, although at this stage we know very little about the biology of this genus.

Key to described species of *Cyphacolus*

1. Fore wing with patch of stout, dark, bristle-like hairs at distal end of submarginal vein proximal to infusate patch, distal margin with obvious fringe of hairs; antennal scape yellow-brown; pedicel, funicle segments and clava dark brown; metasoma strongly convex, with broad, transverse, dark band medially. *C. bhowaliensis* (Mani et Mukerjee)
- Fore wing without patch of stout, dark, bristle-like hairs (Fig. 2), distal margin with or without fringe of hairs; antennal scape, pedicel and funicle segments yellow brown, clava dark brown; metasoma only slightly convex dorsally (Fig. 2), without broad, transverse, dark band medially (Fig. 1). 2
2. Notauli absent; distal margin of fore wing with obvious fringe of hairs. *C. veniprivus* Priesner
- Notauli present (Fig. 3), reaching about 0.5× distance to anterior margin of scutum; distal margin of fore wing without fringe of hairs. *C. bouceki* sp. nov.

Cyphacolus bouceki sp. nov.

(Figs 1–6)

TYPE MATERIAL. Holotype: ♀, “16 km up Davies Rd via Mareeba, Qld, 18.ii–3.iii.1983, Storey, Titmarsh” (QMBA). Paratypes: Queensland: 1 ♀, same data as holotype (QDPC); 7 ♀, same data as holotype except 4–13.iii.1983 (ANIC, QDPC, WINC); 1 ♀, same data as holotype except 2–xii.1984–2.ii.1985 (QDPC); 1 ♀, Camp Mountain (Marks), 15–22.xii.1979, malaise trap, open sclerophyll gully (QDPC); 3 ♀, Mt. Tamborine, 6–17.iii.1981, open forest (QDPC).

DESCRIPTION OF FEMALE. Length: 1.0–1.2 mm; body yellow-brown to brown, except antennal clava and apex of metasomal horn which are dark brown, and anterior margins of metasomal tergites which are slightly darker than rest of tergites.

Head: In anterior view subtriangular in shape; frons smooth medially, with striae either side of antennal insertions radiating to lower margin of eye; frontal carina short; upper frons and vertex with fine coriaceous sculpturing and sparse, short hairs; gena with fine alutaceous-coriaceous sculpturing; in dorsal view head moderately broad, slightly wider than mesosoma; occiput strongly concave; occipital carina medially sinuate; eyes normal in size; lateral ocelli contiguous with margin of eyes; antennal scape reaching 0.75× distance to median ocellus; first funicle segment <2.0× as long as wide, fourth funicle segment transverse; clava large and compact, L:W = 26:15, segments indicated by faint suture lines, with.

Mesosoma: Scutum L:W = 19:3.0, surface with very faint coriaceous sculpturing, almost smooth, with scattered small punctures and associated hairs; notauli reaching about 0.5× distance to anterior margin of scutum; scutellum subrectangular, L:W = 7:23, broadly curved posteriorly, surface smooth and virtually hairless except for row of hairs along anterior margin, anterior margin indistinctly crenulate, posterior margin regularly crenulate with smooth border, in posterior view medial posterior margin slight bowed upward; metanotum coarsely crenulate; propodeum coarsely carinate, with pair of large blunt spines, fore wing L:W = 73:27, hyaline except for infusate spot at wing margin, becoming fainter towards middle of wing, surface with sparse micropilosity, marginal fringe absent.

Metasoma: L:W = 59:35, only slightly convex medially; first tergite with coarse longitudinal carinae which extend onto posterior and sometimes lateral surfaces of horn; dorsal and anterior surfaces of horn smooth; when metasoma in line with mesosoma, horn reaching to about level of

dorsal surface of scutellum; second tergite very finely striate in anterior half, smooth posteriorly; medial length of T2:T3 = 11:20; third to fifth tergites very finely coriaceous almost smooth in anterior two-thirds, smooth posteriorly, each tergite with single transverse row of short hairs; sixth tergite transverse, sometimes hidden; seventh tergite with very long cercal hairs .

Male. Unknown.

COMMENTS. This species is named after our colleague Zdeněk Bouček in celebration of his 80th birthday. It has an apparently disjunct distribution between north Queensland (Mareeba) and two localities close to Brisbane (Mt Tamborine and Camp Mountain) in south-east Queensland. Although the species may also occur at intermediate localities, there is a strong possibility that this species has two naturally isolated populations that were previously linked by more continuous wet forest vegetation that existed down the east coast during the Pleistocene.

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A review of the Eulophidae and Pteromalidae (Hymenoptera: Chalcidoidea) of Greenland

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Abstract. The Eulophidae and Pteromalidae (Hymenoptera: Chalcidoidea) of Greenland are revised, based mainly on material deposited at the Zoological Museum, University of Copenhagen, Denmark. Six species of Eulophidae and nine species of Pteromalidae are listed. Eight species are recorded for the first time from Greenland: *Chrysocharis pubicornis* (Zetterstedt, 1838), *Closterocerus diastatae* (Howard, 1881), *Diglyphus isaea* (Walker, 1838), *Pediobius alaspharus* (Walker, 1839) (Eulophidae); *Glyphognathus laevigatus* (Delucchi, 1953), *Seladerma* cf. *breve* (Walker, 1834), *Seladerma geniculatum* (Zetterstedt, 1838), *Trichomalopsis fucicola* (Walker, 1835) (Pteromalidae). Of the other species, four have been misidentified in the past. The status of many species is investigated, which results in the removal of one nominal taxon, *Elachertus artaeus* (Walker, 1839) **revised status** (Eulophidae), from synonymy (the species is not present in Greenland). Finally, the origin and composition of species are compared with those of other regions, especially Iceland and the Northwest Territories (including Nunavut) in Canada. Generally, Greenland has more species in common with the Palaearctic (nine) than with the Nearctic fauna (one).

Distribution, faunistics, diversity, Hymenoptera, Entedoninae, Eulophinae, Tetrastichinae, Asaphinae, Miscogasterinae, Pteromalinae, Greenland, Nearctic region, Palaearctic region

INTRODUCTION

The Eulophidae and Pteromalidae (Chalcidoidea) of Greenland have received relatively little attention. Holmgren (1872) first described a single, new species from northern Greenland, *Pteromalus groenlandicus* (now Pteromalinae: *Pachyneuron* Walker, 1833), without providing any further data. Lundbeck (1897) recorded another four Pteromalidae and gave a few data concerning their distribution. The same data and an unidentified species of *Pteromalus* Swederus, 1795 were listed in Henriksen & Lundbeck's (1917) catalogue of the land-arthropods of Greenland. Bakkendorf (1955), in his review of the Hymenoptera fauna of Greenland and Iceland, essentially revised Lundbeck's material of Pteromalidae and added one species under Eulophidae, *Tetracyclos boreios* Kryger, 1942, which is now recognized as an encyrtid (Gibson & Yoshimoto 1981). Later authors (e.g. Peck 1963, Graham 1969) more or less quoted from the older literature and only two further eulophids were recorded by Buhl (1997), since Bakkendorf (1955). However, a considerable amount of new material has been accumulated in the Zoological Museum, University of Copenhagen over the past forty years. In the course of a revision of the Pteromalidae and Eulophidae for the „Manual of Greenland Entomofauna“, edited by Jens Böcher and published by the Zoological Museum, SNG, University of Copenhagen (in preparation), this material was examined. Because the handbook is primarily restricted to keys and distribution maps, discussion of status and morphology of taxa had to be dealt with in a separate paper. Such a discussion is indispensable, because it is – even in these days! – often impossible to identify chalcidoids from published keys. The name-bearing types of most species were checked which gave some new insights concerning the status

and variational limits of certain taxa. Furthermore, a comprehensive list of voucher specimens is provided. The origin and composition of Greenland Eulophidae and Pteromalidae are finally compared with those of other arctic regions as well as Europe and North America.

MATERIAL AND METHODS

For the present paper, a total of 119 Eulophidae and 271 Pteromalidae from Greenland were examined. In addition, voucher specimens from other countries as well as name-bearing types were used for comparison. Terminology and morphology follow Gibson (1997). The material from Greenland is mounted and stored very diversely. For instance, many specimens remained for a long time in alcohol, which usually bleaches the colours and distorts proportions of the gaster. This, in turn, often hampers identification, especially in Pteromalidae. Therefore, the way of storing and mounting of specimens from Greenland is mentioned with a single letter right after the acronym of the depository. A specimen is thus either stored in alcohol (a), air dried directly after killing and mounted on a micro-pin, card point or card rectangle (d), or removed from alcohol and mounted on a card rectangle (r). Unless mentioned otherwise, drying and mounting specimens from alcohol was done by me following the method of Heraty & Hawks (1998) except for using amyl acetate instead of hexamethyldisilazane. This method successfully prevented shrivelling, even in the case of soft bodied eulophids. Specimens are deposited in the following institutions: The Natural History Museum, London, England (BMNH); Eidgenössische Technische Hochschule, Zürich, Switzerland (ETHZ); Hungarian Natural History Museum, Budapest, Hungary (HNHM); Muséum d'histoire naturelle, Geneva, Switzerland (MHNG); Natural History Museum, Prague, Czech Republic (NHMP); Naturhistoriska Riksmuseet, Stockholm, Sweden (NHRM); Natural History Museum, Bern, Switzerland (NMBE); University Museum, Oxford, England (UMO); Zoological Museum, University of Copenhagen, Denmark (ZMUC).

RESULTS AND DISCUSSION

List of species

(see also Tab. 1)

Eulophidae

Aprostocetus (Aprostocetus) meltoftei Buhl, 1997

TYPE MATERIAL EXAMINED. **Greenland, North-East Greenland:** Langelandselv, 2 ♀ (ZMUC-a); Zackenberg, 9 ♀ 5 ♂ (ZMUC-r), 2 ♀ 3 ♂ (ZMUC-a), 10 ♀ 6 ♂ (NMBE-r). *A. meltoftei*, holotype ♀ labelled „APROSTOCETUS MELTOFTEI ♀ P. N. Buhl det. 1996; 8.7.96 P st. 5; HOLOTYPE [red]“ and paratypes 3 ♀, 1 ♂ from Zackenberg (ZMUC-r) [the type series was probably removed from alcohol without any further treatment before mounting on card points; all specimens are thus very badly shrivelled]. **North-West Greenland:** Thule, 2 ♀ [det. Bakken-dorf „*Tetrastichus brachycerus* Thomson, 1878“] (ZMUC-r), Thule, Blaso, 2 ♂ (ZMUC-a).

ADDITIONAL MATERIAL EXAMINED. *A. caudatus* (Westwood, 1833), many specimens from Central Europe in BMNH, NMBE; *A. meroe* Graham, 1987, paratypes 55 ♀ 2 ♂ (BMNH) from England, Southgate, Oxford and France, Mt. Ventoux; *Cirrospilus eleuchia* Walker, 1839, lectotype ♂ from Great Britain (BMNH TYPE HYM. 5.2836); *C. nymphis* Walker, 1839, lectotype ♂ from Great Britain (BMNH TYPE HYM. 5.2830); *C. oropus* Walker, 1839, lectotype ♂ from Great Britain (BMNH TYPE HYM. 5.2633); *C. rhipheus* Walker, 1839, lectotype ♀ from Great Britain (BMNH).

TAXONOMIC CONSIDERATIONS. All specimens from Greenland are conspecific with the type series of *Aprostocetus meltoftei*, which clearly belongs to the *A. caudatus* species-group of Graham (1987). However, there is some doubt concerning the validity of *A. meltoftei*. In the original description, Buhl (1997) separated the species mainly from *A. caudatus*, *A. meroe* and *A. rhipheus* (Walker, 1839), from which it is clearly distinct [he furthermore mentioned *A. pachyneuros* (Ratzeburg, 1844) and *Baryscapus chlamytis* (Ashmead, 1896), which are not related to the species in question]. Some further related species, *Aprostocetus eleuchia*, *A. nymphis*, and *A. oropus*, were not mentioned. These were included in Graham's (1987) key to the species of *Aprostocetus* Westwood, 1833 solely based on the respective lectotype males, which are very close to *A. meltoftei*. While *A.*

eleuchia and *A. nymphis* show some slight differences in the shape of the antenna (see Graham 1987), *A. oropus* differs from *A. meltoftei* only in the slightly larger body size of 1.37 mm (0.9–1.1 mm in *A. meltoftei*). Therefore, the latter two species might actually be the same. Given the lack of additional topotypical material of *A. oropus*, I hesitate to synonymize the two species. Because all specimens of the type series of *A. meltoftei* are very badly shrivelled, I give here some of the diagnostic characters based on the above mentioned, intact material from Zackenberg.

Female: combined length of pedicel plus flagellum 1.0–1.1 times as long as mesoscutum width; tegula only slightly darkened; mid lobe of mesoscutum about 0.9 times as long as wide, median line superficial and sometimes indistinct; propodeum medially about as long as dorsellum, only moderately deeply emarginate; gaster distorted in alcohol specimens, but apparently ovate, acute and hardly acuminate; tip of hypopygium at about 0.55 length of gaster; length 1.1–1.2 mm. ♂: combined length of pedicel plus flagellum 1.60–1.70 times as long as mesoscutum width; scape 2.25–2.50 times as long as wide, ventral plaque confined to lower half, 0.37–0.42 times as long as scape; first funicular segment about quadrate; scutellum with submedian lines distinctly nearer to sublateral lines than to each other; length 0.9–1.1 mm.

DISTRIBUTION. *Aprostocetus meltoftei* is known only from Thule, Langelandselv and Zackenberg in northern Greenland. The latter was already mentioned by Buhl (1997).

***Chrysocharis pubicornis* (Zetterstedt, 1838)**

MATERIAL EXAMINED. **Greenland, West Greenland:** Sarqaq, Kapisigdlit, 1 ♀ (ZMUC-a); Tigssaluk, 1 ♂ (ZMUC-d). **South-West Greenland:** Fiskenaesfjorden, opposite Amigfik, 1 ♂ (ZMUC-a). **South Greenland:** Kap Farvel-området, Kangersuneq qingordleq, Igdlorssuit, 1 ♀ 3 ♂ (ZMUC-r); Kap Farvel-området, Kangikitsok, Tupaussat, 1 ♀ 1 ♂ [det. Hansson] (NMBE-r), 1 ♀ 1 ♂ (NMBE-r), 2 ♀ 4 ♂ (ZMUC-r), 3 ♂ (ZMUC-a); Kap Farvel-området, Pamiagdlok, Anordliutsoq, 1 ♂ [det. Hansson] (NMBE-r), 1 ♀ 3 ♂ (ZMUC-r), 1 ♀ 4 ♂ (ZMUC-a); eastern Narsaq community, Dolfi Lund, 1 ♀ (ZMUC-a); 1 ♂ (NMBE-d); Narssarssuaq, 3 ♂ (ZMUC-d), 1 ♀ 1 ♂ (NMBE-d), 1 ♀ 2 ♂ (NMBE-a); Upernaviarssuk, 3 ♀ 3 ♂ (ZMUC-a).

ADDITIONAL MATERIAL EXAMINED. Many specimens from Northern and Central Europe in BMNH, ETHZ, MHNG, NMBE.

TAXONOMIC CONSIDERATIONS. Specimens from Greenland fit the description of *C. pubicornis* by Hansson (1985) and the European material well.

DISTRIBUTION. *C. pubicornis* occurs in western and southern coastal areas of Greenland. The species is widely distributed in the Holarctic region (Noyes 2002), but had not yet been recorded from Greenland.

***Closterocerus diastatae* (Howard, 1881)**

MATERIAL EXAMINED. **Greenland, South-Greenland:** Kap Farvel-området, Kangikitsok, Tupaussat, 1 ♀ [det. Hansson] (ZMUC-r), 1 ♀ [det. Hansson] (NMBE-r); Narssarssuaq, 1 ♀ [det. Hansson], 1 ♀ (ZMUC-r), 1 ♀ [det. Hansson] (NMBE-r).

TAXONOMIC CONSIDERATIONS. The five specimens run to *C. diastatae* in Hansson's (1995) key of those Nearctic species of *Closterocerus* Westwood, 1833, which were earlier placed in *Neochrysocharis* Kurdjumov, 1912.

DISTRIBUTION. *C. diastatae* is known only from Tupaussat and Narssarssuaq on the southern coast of Greenland. It is widely distributed in North and Central America and China (Hansson 1995, Noyes 2002), but had not yet been recorded from Greenland.

Diglyphus isaea (Walker, 1838)

MATERIAL EXAMINED. **Greenland, West Greenland:** Nugatsiaq, 1 ♂ (ZMUC-d); Sarqaq, Kapisigdlit, 1 ♀ (ZMUC-a); Sondre Stromfjord, 1 ♀ (ZMUC-a); Svartenhuk, Svartenhavn, 1 ♂ (ZMUC-a). Umanak Fjord, Drygalskis Halvø, Kujadtlíkavsaq, 1 ♂ (NMBE-d); Umanak Fjord, Qarassap nunata, 1 ♂ (ZMUC-a). **South Greenland:** Julianehaab, Eqaluit-landet, 1 ♀ (ZMUC-a); Herjolfsnes [= Ikigait], 2 ♀ (NMBE-a); Julianehaab, K'nissartu, [= Qanisartuut], 1 ♀ (ZMUC-a); Kap Farvel-området, Pamiagdlok, Anordliutsoq, 2 ♂ (NMBE-a); Narssarsuaq, 1 ♂ (ZMUC-a); Upernaviarssuk, 1 ♀ 3 ♂ (NMBE-a).

ADDITIONAL MATERIAL EXAMINED. Many specimens from Northern and Central Europe in BMNH, ETHZ, MHNG, NMBE.

TAXONOMIC CONSIDERATIONS. Specimens from Greenland fit the description of *D. isaea* by Graham (1959) and Askew (1968) and the European material very well.

DISTRIBUTION. *D. isaea* occurs in western and southern coastal areas of Greenland. It is widely distributed in the Palaearctic region (Noyes 2002), but had not yet been recorded from Greenland.

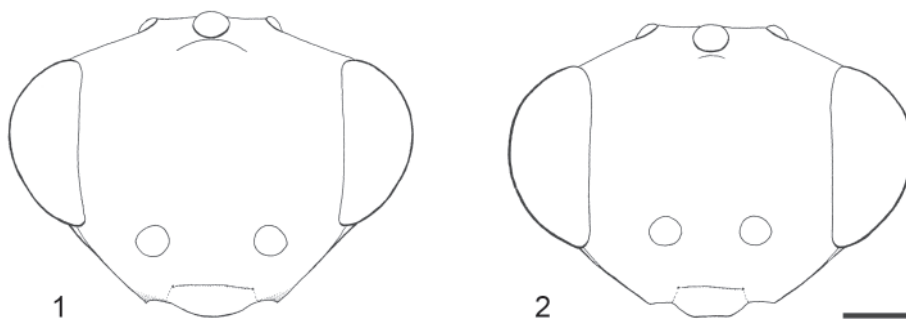
Elachertus fenestratus Nees, 1834

MATERIAL EXAMINED. **Greenland, North-East Greenland:** Scoresbysund, Coloradodal, 1 ♀ (ZMUC-r); Zackenberg, 1 ♀ (NMBE-r), 2 ♀ [considered by Buhl (1997) as males of *Elachertus artaeus* (Walker)] (ZMUC-r, mounted by Buhl). **North-West Greenland:** Thule, Blomstersoe, 1 ♀ (ZMUC-r).

ADDITIONAL MATERIAL EXAMINED. *Diplolepis lateralis* Spinola, 1808, neotype ♀ from Italy [for notes concerning labels and the state of the specimen, see Bouček & Schauff (1988)] (BMNH TYPE HYM. 5.3047). *Elachertus fenestratus*, lectotype ♀ from Germany [for notes concerning labels and the state of the specimen, see Graham (1988)] (UMO). *Eulophus argissa* Walker, 1839, lectotype ♀ from Great Britain (BMNH TYPE HYM. 5.2614). *Eulophus artaeus* Walker, 1839, lectotype ♀ from Great Britain (BMNH TYPE HYM. 5.2617). *Elachertus artaeus*, *E. fenestratus*, *E. lateralis*: many specimens from Northern and Central Europe in BMNH, ETHZ, MHNG, and NMBE.

TAXONOMIC CONSIDERATIONS. *Elachertus fenestratus* is characterized by a straight transscutal articulation and an elongate petiole (Schauff 1985). It is thus very similar to *E. lateralis*, from which it has traditionally been separated by a darker coloration of body and coxae and a more elongate gaster (Graham 1959, Askew 1968, Zhu & Huang 2001). However, these characters proved difficult for many specimens, in particular concerning alcohol material with faded colours and distorted proportions of gaster, which is the case for all specimens from Greenland. It was therefore necessary to compare those specimens with the respective name-bearing types and some additional material. As a result, it was found that *E. lateralis* consists of two species; *E. artaeus*, which has been considered a synonym of *E. lateralis* (e.g. by Bouček & Schauff 1985, Zhu & Huang 2001), is actually a valid species. The female diagnostic characters of the three species are presented in the following key:

- 1 Head in frontal view (Fig. 1) with lower margin of toruli distinctly below level of lower ocular line; toruli separated by 2.3–2.6 times their diameter; malar space 0.55–0.58 times as long as eye height. Scape slender, about 6.0 times as long as wide and 1.05–1.11 times as long as eye height, extending to level of anterior edge of anterior ocellus. [Body olive green, legs entirely testaceous except for a dark spot on the dorso-lateral aspect of hind coxa, gaster dorsally with a large pale spot at base, ventrally almost completely pale]. *Elachertus artaeus* (Walker) revised status
- Head in frontal view (Fig. 2) with lower margin of toruli at about level of lower ocular line; toruli separated by 1.8–2.0 times their diameter; malar space 0.31–0.45 times as long as eye height. Scape stout, 3.7–4.5 times as long as wide and about 0.80–0.89 times as long as eye height, not extending to level of anterior edge of anterior ocellus. 2
- 2 Gaster 1.2–1.4 times as long as wide; body olive green, legs entirely testaceous except sometimes for a dark spot on the dorso-lateral aspect of hind coxa, gaster dorsally with a large pale spot at base or wholly testaceous. *Elachertus lateralis* (Spinola)
- Gaster 1.4–1.8 times as long as wide; body dark olive green to black, legs testaceous with all coxae testaceous [lectotype] or with some of the coxae more or less infuscate, gaster dorsally often with a hardly discernible pale spot at base. *Elachertus fenestratus* Nees [syn. *E. argissa* (Walker)]



Figs 1, 2. (1) *Elachertus artaeus* (Walker): head in frontal view of a ♀ from southern France, Mont Ventoux (in BMNH, Baur no. 2171); (2) *Elachertus lateralis* (Spinola): head in frontal view of neotype ♀ from Italy, Albenga, Ceriale (in BMNH). Scale 0.1 mm.

The differences between *E. lateralis* and *E. fenestratus* are fuzzy, i.e. it is difficult to assign certain specimens to one or the other species. The two taxa might therefore be only colour forms of a single species. However, the specimens from Greenland are dark olive green, with only procoxa and base of ventral side of gaster testaceous. They are thus considered conspecific with the lectotype of *E. fenestratus*.

DISTRIBUTION. The few available records of *E. fenestratus* suggest a rather northern distribution in coastal areas of Greenland. As mentioned above, the two males recorded by Buhl (1997, sub *E. artaeus*) from Zackenberg are actually females belonging to *E. fenestratus* (Nees). This species is widely distributed in the Palearctic region and North and Central America (Noyes 2002).

Pediobius alaspharus (Walker, 1839)

MATERIAL EXAMINED. **Greenland, South Greenland:** Ivigtut [= Ivittuut], 1 ♀ (ZMUC-r).

ADDITIONAL MATERIAL EXAMINED. *Pediobius eubius* (Walker, 1839) species-aggregate (Dawah 1988): many specimens from Northern and Central Europe in BMNH, NMBE. *Entedon alaspharus* Walker, lectotype ♀ from England (BMNH TYPE HYM. 5.2024). *Pediobius claridgei* Dawah, 1988, holotype ♀ from England (BMNH TYPE HYM. 5.3395). *P. dactylicola* Dawah, 1988, holotype ♀ from Great Britain (BMNH TYPE HYM. 5.3397). *P. deschampsiae* Dawah, 1988, holotype ♀ from Wales (BMNH TYPE HYM. 5.3398). *P. festucae* Dawah, 1988, holotype ♀ from Wales (BMNH TYPE HYM. 5.3396).

TAXONOMIC CONSIDERATIONS. The female from Greenland clearly belongs to the *Pediobius eubius* species-aggregate as defined by Bouček (1965) and Dawah (1988). However, recognition of a species with the key of Dawah (1988) proved very difficult, therefore the name-bearing types had to be checked for identification. Concerning the above listed species, the female from Greenland most closely fits the lectotype of *P. alaspharus*. The former differs only in very slightly darker meso- and metatarsi, but this is considered as individual variation.

Some of the characters given by Dawah (1988) for *P. alaspharus* do not match the lectotype, hence the latter is partly re-described here: meso- and metatarsi with segments 1–3 light yellowish testaceous, segment 3 slightly darker than segments 1–2; distance between frontal fork and meeting point of scrobal grooves hardly as long as length of an eye facet; pedicel plus flagellum 0.77 times as long as head width [flagellum thus clearly *shorter* than head width, corresponding to figure 15 rather than figure 13 in Dawah (1988: 1154)]; scutellum 1.21 times as long as mesoscutum;

parastigma plus marginal vein 1.18 times as long as fore wing width [not „more than 1.3 times“ as stated by Dawah (1988: 1157)]; gaster 1.93 times as long as wide, 0.89 times as long as head plus mesosoma; length 2.53 mm.

DISTRIBUTION. *Pediobius alaspharus* was collected only in Ivittuut on the southern coast of Greenland. It is known from Northern and Central Europe (Noyes 2002), but had not yet been recorded from Greenland.

Pteromalidae

Ardilea convexa (Walker, 1833)

MATERIAL EXAMINED. **Greenland:** without locality, 4 ♀ (ZMUC-r), 10 ♀ 5 ♂ (ZMUC-a), „Fangglar pa elvbred“, 1 ♂ (ZMUC-a). **West Greenland:** Brededal, Disko, 2 ♂ (ZMUC-d); Godhavn, 1 ♂ (ZMUC-d); Ingia Fjord, Silardleq, Sagdlarutsip nunata, 1 ♂ (ZMUC-d); Nugatsiaq, 1 ♀ 1 ♂ (ZMUC-d); Qegertaksuaq, Nordre Stromfjord, 1 ♂ (ZMUC-a); Qegertasussuk, Disko Bugt, 1 ♀ (ZMUC-a); Sarqaq, 1 ♀ 1 ♂ (ZMUC-r), 1 ♂ (ZMUC-a); Sarqaq, Kapisigdlit, 1 ♂ (ZMUC-d), 2 ♀ 1 ♂ (ZMUC-a); Sondre Stromfjord, 2 ♀ (ZMUC-a); Tassiusak [= Tasiusaq], 1 ♀ [det. Bakkendorf „*Lamprotatus ?pilicornis* Thomson“] (ZMUC-d); Umanak Fjord, Qarassap nunata, 1 ♀ (NMBE-d), 1 ♀ (ZMUC-a); Unartok Kloster, 2 ♀ (ZMUC-a); Upernavik, 1 ♂ (ZMUC-a); Uvkusigssat Fjord, Pangnertok, 1 ♀ (NMBE-d), 1 ♀ 2 ♂ (ZMUC-d). **South-West Greenland:** east Naujarssuit, Bjoernesund, 2 ♂ (ZMUC-d); Evighedsfjord, Taterat, 1 ♂ (NMBE-d); Fiskefjord, Igdlutalik, 1 ♀ (NMBE-d); Fiskenaasset, 1 ♂ (NMBE-d); Graedefjord, Islet Nugssuaq, 1 ♂ (ZMUC-d); Graedefjord, Nugssuaq, 2 ♂ (NMBE-d); Kvanefjord, Nigerdlikasik, 3 ♂ (NMBE-d); Sondre Isortoq, Bay, 1 ♀ (NMBE-d). **South-East Greenland:** Skjoldungen, 2 ♂ (ZMUC-a); Skjoldungen, „Bygden“, 4 ♀ 16 ♂ (ZMUC-a). **South Greenland:** Arsuk, 3 ♀ 1 ♂ [det. Bakkendorf „*Lamprotatus ?pilicornis* Thomson“] (ZMUC-d); Frederiksdal, Herjolfssnes, 1 ♀ (ZMUC-a); Frederiksdal, Itiutlikasik, 1 ♀ (ZMUC-d), 1 ♂ (ZMUC-a); Gronnedal, 1 ♀ (ZMUC-d); Ipiutat, 1 ♀ [det. Bakkendorf „*Lamprotatus ?pilicornis* Thomson“] (ZMUC-d); Kap Farvel-området, Kangarsuneq qingordleq, Igdlorssuit, 1 ♂ (ZMUC-r); Kap Farvel-området, Pamiagdhluk, Anordliuitsok, 1 gonander (ZMUC-r), 2 ♂ (ZMUC-r); Narssarssuaq, 1 ♀ 1 ♂ (ZMUC-d), 3 ♀ 3 ♂ (ZMUC-a); Nekamiut, 1 ♀ [det. Bakkendorf „*Lamprotatus ?pilicornis* Thomson“] (ZMUC-d); Neriak, 1 ♀ [det. Bakkendorf „*Lamprotatus ?pilicornis* Thomson“] (ZMUC-d); Tasermiut, Quinqua-dalen, 1 ♂ (ZMUC-a).

ADDITIONAL MATERIAL EXAMINED. *Miscogaster convexa* Walker, 1833, lectotype ♂ from England (B.M. TYPE HYM. 5.1927).

TAXONOMIC CONSIDERATIONS. Specimens from Greenland fit the description of *A. convexa* by Graham (1969) and the lectotype very well.

DISTRIBUTION. *Ardilea convexa* is widely distributed in coastal areas of western and southern Greenland. Before Graham (1969), it was recorded from Greenland by Lundbeck (1897) and Bakkendorf (1955) as *Lamprotatus ?pilicornis* Thomson, 1876 [misidentification]. The species is known from several countries in Northern Europe (Graham 1969, Noyes 2002).

Asaphes hirsutus Gibson et Vikberg, 1998

MATERIAL EXAMINED. **Greenland:** Magdlak, A. Wegeners Halvø, 1 ♂ (ZMUC-a). **West Greenland:** Godhavn, 1 ♂ (ZMUC-d); Ingia Fjord, Silardleq, Sagdlarutsip nunata, 1 ♂ (ZMUC-d); Kaersut, 1 ♂ (ZMUC-r); Sarqaq, Kapisigdlit, 1 ♂ (ZMUC-r), 3 ♂ (ZMUC-a); Umanak Fjord: Drygalskis Halvø, Kujadtlikavsak, 1 ♂ (ZMUC-d), 1 ♂ (NMBE-d); Ikerasak, 1 ♂ (NMBE-d); Kangerdluarssuk, Kangerdluarssub qeqerta, 1 ♂ (ZMUC-d); Kangerdluarssuk, Kangerdlugssuakavsak, 1 ♀ 1 ♂ (NMBE-d); Qarassap nunata, 1 ♂ (ZMUC-a); Uvkusigssat Fjord, Pangnertok, 1 ♀ 2 ♂ (ZMUC-d). **South-West Greenland:** Fiskenaasset, 2 ♀ (NMBE-d); Itivleq, eastern end, 1 ♂ (ZMUC-d); Maniitsoq (Sukkertoppen), 1 ♂ (ZMUC-d). **South Greenland:** Arsuk, 2 ♂ [det. Lundbeck „*Isocratus vulgaris* Walker“; det. Bakkendorf „*Asaphes vulgaris* Walker“] (ZMUC-d); Ipiutat, 1 ♀ [det. Lundbeck „*Isocratus vulgaris* Walker“; det. Bakkendorf „*Asaphes vulgaris* Walker“] (ZMUC-d); Julianehaab [= Qaqortoq], 1 ♀ (ZMUC-a); Kap Farvel-området, Kangarsuneq qingordleq, Igdlorssuit, 2 ♀ 1 ♂ (ZMUC-r), 1 ♀ (ZMUC-a); Kap Farvel-området, Kangikitsoq, Tupaussat, 2 ♂ (ZMUC-a); Kap Farvel-området, Pamiagdhluk, Anordliuitsok, 2 ♀ 13 ♂ (ZMUC-r), 2 ♀ 2 ♂ (NMBE-r), 2 ♀ 11 ♂ (ZMUC-a); Kussuaq, Narsaq, 1 ♀ (ZMUC-a); Sermiliarsuk, 1 ♀ [det. Lundbeck „*Isocratus vulgaris* Walker“; det. Bakkendorf „*Asaphes vulgaris* Walker“] (ZMUC-d).

ADDITIONAL MATERIAL EXAMINED. *A. hirsutus*: **Canada**: Quebec, St. Gedeon, paratype 1 ♀ (BMNH). **Italia**: South Tyrol, Dolomiten, paratype 1 ♀ (BMNH). *A. pubescens* Kamijo et Takada, 1973, paratypes 1 ♀, 1 ♂ from Japan, Hokkaido, Sapporo, (BMNH). *A. vulgaris* Walker, 1834 and *A. suspensus* (Nees, 1834): many specimens from Northern and Central Europe in BMNH, ETHZ, MHNG, NMBE.

TAXONOMIC CONSIDERATIONS. All specimens of *Asaphes* Walker, 1834 from Greenland fit paratypes of *A. hirsutus* in BMNH and the description by Gibson et Vikberg (1998) well, except that a few larger females bear 1 or 2 longitudinal sensilla on the second anellus. The specimens furthermore lack a forewing speculum and the lower posterior edge of the metapleuron is pilose, while the central part of the mesoscutum side lobe is bare. They are thus clearly distinct from the similar *A. pubescens* which has the mesoscutum entirely covered with short setae.

DISTRIBUTION. *A. hirsutus* is widely distributed in coastal areas of western and southern Greenland. It was recorded from Greenland by Lundbeck (1897) as *Isocratus vulgaris* (Walker) and by Bakkendorf (1955) and Graham (1969) as *Asaphes vulgaris* Walker [misidentifications]. *A. hirsutus* is widely distributed in the Holarctic region, where it is mostly collected at high altitudes (Gibson et Vikberg, 1998).

Callimerismus suecicus Graham, 1969

MATERIAL EXAMINED. **Greenland**: „Btr. draw“ [?], 1 ♂ [det. Bakkendorf „*Cryptoprymna ater* (Walker)“] (ZMUC-d); Mestersvig, 1 ♀ (ZMUC-a); Orpigsuit, 1 ♂ [det. Lundbeck „*Spegigaster* sp.“; det. Bakkendorf „*Cryptoprymna ater* (Walker)“] (ZMUC-d); without locality, 3 ♀ 1 ♂ (ZMUC-a). **North-East Greenland**: Ellae, 1 ♀ 2 ♂ (ZMUC-a). **East Greenland**: Charcots land, 1 ♀ (ZMUC-r), 1 ♂ (ZMUC-d); Faxø, 2 ♀ 1 ♂ (ZMUC-d). **West Greenland**: Godhavn, 2 ♂ (NMBE-d); Godhavn, 1 ♀ (ZMUC-a); Ingia Fjord, Puatdlarsiviup qorua, 1 ♀ (NMBE-d); Nugatsiaq, 2 ♀ (NMBE-d); Umanak, 1 ♀ (ZMUC-a); Umanak Fjord, Kangerdluarssuk, Kangerdlugssuakavsak, 1 ♂ (NMBE-d). **South-West Greenland**: Fiskenaesset, 1 ♂ (NMBE-d); Graedefjord, Nugssuaq, 2 ♂ (ZMUC-d); Itivleq, eastern end, 1 ♂ (NMBE-d); Kvaneffjord, 1 ♂ [det. Lundbeck „*Dicyclus* sp.“; det. Bakkendorf „*Cryptoprymna ater* (Walker)“] (ZMUC-d). **South Greenland**: Gronnedal, 1 ♀ (ZMUC-a); Kap Farvel-området, Pamiagdlok, Anordliutsoq, 1 ♀ 1 ♂ (ZMUC-r), 1 ♀ (ZMUC-a); Narssarssuaq, 1 ♀ 2 ♂ (ZMUC-d), 3 ♀ (ZMUC-a).

ADDITIONAL MATERIAL EXAMINED. *Callimerismus suecicus*, holotype ♀ from Sweden (BMNH TYPE HYM. 5.3464).

TAXONOMIC CONSIDERATIONS. Specimens from Greenland fit the holotype and the description of *C. suecicus* by Graham (1969) very well.

DISTRIBUTION. *Callimerismus suecicus* is widely distributed in coastal areas from northern to southern Greenland. It was hitherto known from Northern and Central Europe (Noyes 2002), but was also recorded from Greenland by Lundbeck (1897) as *Sphegigaster* sp. and *Dicyclus* sp. respectively, and by Bakkendorf (1955) as *Cryptoprymna ater* [= *atra*] (Walker, 1833) [misidentifications].

Glyphognathus laevigatus (Delucchi, 1953)

MATERIAL EXAMINED. **Greenland, West Greenland**: Umanak, 1 ♀ (ZMUC-d); Umanak Fjord, Qarassap nunata, 1 ♂ (NMBE-r). **South-West Greenland**: Søndre Isortoq, Nuk, (NMBE-d). **South Greenland**: Kap Farvel-området, Kangersuneq qingordleq, Igdlorssuit, 1 ♀ (NMBE-r); Kap Farvel-området, Kangikitsok, Tupaussat, 1 ♀ (ZMUC-r); Kap Farvel-området, Pamiagdlok, Anordliutsoq, 1 ♀ 3 ♂ (ZMUC-r), 1 ♀ 1 ♂ (NMBE-r).

ADDITIONAL MATERIAL EXAMINED. Holotype *Stictomischus laevigatus* (on card rectangle, entire) labelled “Foktö 1943.VIII.13. dr. Erdős; *Stictomischus laevigatus* n. V. Delucchi det.; ♀; TYPE [red]; Holotype ♀ *Stictomischus laevigatus* Delucchi lab. H. Baur 1997 [red]” [the sequence of the labels has changed and one label „17.“ is missing since Graham’s (1969: 213) quotation] (HNHM). **CROATIA**: Durmitor, 1 ♀ (NHMP). **CZECH REPUBLIC**: Bohemia, 4 ♀ 2 ♂ (NHMP). **ENGLAND**: Berkshire, Wytham, 1 ♂ (NHMP). **SWEDEN**: Skane, 1 ♀ 1 ♂ (NHMP). Holotype *Stictomischus laevis* Delucchi, 1953 (on card rectangle, entire) labelled “Köszegi h 1944.V.22. dr. Erdős; rét; 14.; *Stictomischus laevis* n. V. Delucchi det.; ♀; TYPE [red]; Holotype ♀ *Stictomischus laevis* Delucchi lab. H. Baur 1997 [red]” [the sequence of the labels has changed since Graham’s (1969: 212) quotation] (HNHM).

TAXONOMIC CONSIDERATIONS. *Glyphognathus laevis* and *G. laevigatus* are very similar and can be separated only by the combined length of pedicel plus flagellum. In *G. laevis* it is about 1.45 times as long as the head width, in *G. laevigatus* only 1.2–1.35. Other characters, such as differences in length of petiole or body colour, which were mentioned by Graham (1969), do not work consistently. Re-examination of the holotype of *G. laevis* revealed, that the particular purplish tints on head and mesosoma are most likely due to an artefact. I have seen similar colour patterns in other miscogasterines, which, for instance, turned from green to dark blue or purple after direct contact with ethyl acetate (Baur unpubl.).

Considering the length of the flagellum, the specimens from Greenland clearly belong to *G. laevigatus*. The most notable difference to continental specimens (including the holotype) lies in their considerably larger body size. Therefore the most important characters of the Greenland specimens are described and are compared with those of the holotype (in brackets).

♀: body green with purplish tints, especially in specimens remounted from alcohol [green with golden tints]; scape green, pedicel and flagellum fuscous; femora fuscous in basal three quarters, tibiae slightly infuscate; head 2.05–2.12 [2.04] times as long as wide; POL 1.30–1.43 [1.39] times OOL; scape 0.73–0.78 [0.70] times as long as eye height; pedicel plus flagellum 1.29–1.35 [1.29] times as long as head width; pedicel about as long as first funicular segment [14:13]; sixth funicular segment quadrate or slightly longer than wide [12:11]; eye 1.28–1.36 [1.30] times as high as wide; scutellum strongly convex in lateral view; frenum reticulate with areoles isodiametric; fore wing with stigma semicircular, 0.90–0.98 [0.90] times as long as high, separated by 1.25–1.35 [1.33] times its height from postmarginal vein; median carina of propodeum complete but irregular medially; plicae indicated in posterior third to half [posterior third]; petiole laterally without setae, very weakly alutaceous on upper side, 1.26–1.53 [1.30] times as long as wide; length (n=1) 2.1 mm [1.35] mm, head width 0.66–0.69 [0.51] mm, metatibia length 0.60–0.67 [0.44] mm. ♂ similar to ♀ except: POL 1.55–1.64 times OOL; pedicel plus flagellum 1.59–1.65 times as long as head width; pedicel about half as long as first funicular segment; sixth funicular segment 1.30–1.50 times as long as wide.

DISTRIBUTION. *G. laevigatus* is restricted to a few localities in western and southern Greenland. It is widely distributed in Northern and Central Europe (Noyes 2002), but had not yet been recorded from Greenland.

Pachyneuron groenlandicum (Holmgren, 1872)

MATERIAL EXAMINED. **Greenland:** without locality, 2 ♂ (NMBE-r). **West Greenland:** Sarqaq, 1 ♀ (ZMUC-r), 1 ♀ (NMBE-r); Sondre Stromfjord, 1 ♀ (ZMUC-r); Umanak, 2 ♂ (ZMUC-r). **East Greenland:** Faxe so, Gaaselandet, 1 ♀ (ZMUC-d). **South-West Greenland:** Evighedsfjord, Taterat, 1 ♀ (NMBE-d). **South Greenland:** Igaliko [= Igaliku], 3 ♀ [det. Lundbeck „*Pachyneuron groenlandicum* (Holmgren)“] (ZMUC-d); Narssarsuaq, 1 ♀ (ZMUC-d); Upernaviarssuk, 3 ♀ (ZMUC-r), 2 ♀ (NMBE-r). *Pteromalus groenlandicus* Holmgren, lectotype ♀ (directly pinned, entire) designated by Hedqvist (1977) and labelled „Grönland Nordskj. Exp.; Lectotypus *Pteromalus groenlandicus* Hlmgr. K.-J. Hedqvist det. 1977 [pink]“ (NHRM); paralectotype ♂ with same data as lectotype (NHRM).

ADDITIONAL MATERIAL EXAMINED. Many specimens from Northern and Central Europe in BMNH, ETHZ, MHNG, NMBE.

TAXONOMIC CONSIDERATIONS. Most specimens fit the lectotype of *P. groenlandicum* very well. However, the three females from Igaliko are very small. Furthermore, they have a relatively short propodeum and wide petiole, the latter being slightly asymmetric in one specimen. Otherwise, they match the lectotype of *P. groenlandicum* (see Graham 1969) and are thus considered conspecific.

DISTRIBUTION. *P. groenlandicum* occurs in western, eastern and southern Greenland. Beside the original mention from North Greenland by Holmgren (1972), it was also recorded from Igaliko (South Greenland) by Lundbeck (1897) and Bakkendorf (1955). The species is widely distributed in the Palaearctic region (Noyes 2002).

***Pteromalus* sp. [nr. *P. semotus* (Walker, 1834)]**

MATERIAL EXAMINED. **Greenland:** without locality, 1 ♀ (ZMUC-d). **West Greenland:** Kangerlussuaq, 1 ♂ (ZMUC-r); Sarqaq, Kapisigdlit, 1 ♂ (ZMUC-r); Sondre Strom, Air Base, 1 ♀ 1 ♂ (ZMUC-r); Sondre Stromfjord, 2 ♀ 1 ♂ (ZMUC-d); Tigssaluk, 1 ♂ (ZMUC-d). **South-West Greenland:** Ameralik, Eqaluit ilordlit, 3 ♀ 4 ♂ (NMBE-d), 2 ♀ 4 ♂ (ZMUC-d); Itivleq, eastern end, 2 ♀ (ZMUC-d).

TAXONOMIC CONSIDERATIONS. All specimens belong to a single species. The female keys out at couplet 73, *P. semotus*, of Graham's (1969) key to European species of *Pteromalus* Swederus, 1795, the male at couplet 63, *P. dolichurus* (Thomson, 1878), or couplet 65, *P. semotus*. From the re-description by Gijswijt (1999), *P. sylveni* (Hedqvist, 1979) is apparently also rather close. However, the species from Greenland clearly does not belong to any European species. It is perhaps undescribed or might belong to an North American species, but this can only be decided after a revision of the Nearctic species of *Pteromalus*.

DISTRIBUTION. The species is restricted to a few localities in western and southern Greenland. The genus was already recorded from Greenland as „*Pteromalus* [s. lat.] sp.“ by Henriksen et Lundbeck (1917) and as „*Habrocytus* sp.“ by Bakkendorf (1955). However, it is doubtful, whether those species really belong to *Pteromalus* in the current sense. *Pteromalus* is one of the largest pteromalid genera and is mainly Holarctic in distribution (Noyes 2002).

***Seladerma* cf. *breve* (Walker, 1834)**

MATERIAL EXAMINED. **Greenland, North-East Greenland:** Morkefiord, 2 ♀ (ZMUC-r).

TAXONOMIC CONSIDERATIONS. The two specimens are clearly conspecific. However, both are in very bad condition with faded colours, partly collapsed mesosoma and swollen gaster. Identification is therefore very difficult, though the available evidence suggests that they may belong to the *Seladerma breve* species-group (Graham 1969). However, fresh material is necessary to confirm the identity of the species.

DISTRIBUTION. *Seladerma* cf. *breve* is known only from Morkefiord in north-eastern Greenland. The genus *Seladerma* Walker, 1834 is Holarctic in distribution (Noyes 2002), but had not yet been recorded from Greenland.

***Seladerma geniculatum* (Zetterstedt, 1838)**

MATERIAL EXAMINED. **Greenland, South Greenland:** Julianehaab, Eqaluit, 1 ♂ (ZMUC-r).

ADDITIONAL MATERIAL EXAMINED. specimens from Switzerland, England, Germany in BMNH, ETHZ, NMBE.

TAXONOMIC CONSIDERATIONS. The specimen very nicely fits the diagnostic characters given by Graham (1969) for European material.

DISTRIBUTION. *Seladerma geniculatum* was collected only in Eqaluit, southern Greenland. The species is widely distributed in Northern and Central Europe (Noyes 2002), but had not yet been recorded from Greenland.

***Trichomalopsis fucicola* (Walker, 1835)**

MATERIAL EXAMINED. **Greenland:** without locality, 1 ♀ (ZMUC-r), 1 ♀ (NMBE-r). **West Greenland:** Sarqaq, Kapisigdlit, 3 ♀ (ZMUC-r), 2 ♀ (NMBE-r).

ADDITIONAL MATERIAL EXAMINED. **England:** S.W. Cornwall, Whitesand Bay, SW 355264 21.vi.1978 leg. A. Pont (on seashore) ex puparia *Leptocera zosteræ* [= *Thoracochaeta zosteræ* (Haliday), Diptera: Sphaeroceridae], 1 ♀ 2 ♂

(BMNH); same data except ex puparia *Fucellia tergina* (Zetterstedt) (Diptera: Anthomyiidae), 1 ♀ (BMNH); **Iceland**: Kollafjörður, 1 ♀ [det. Bakkendorf „*Eurydinota leptomera* Förster“] (ZMUC). *Pteromalus fucicola*, lectotype ♀ from England (BMNH TYPE HYM. 5.2818).

TAXONOMIC CONSIDERATIONS. As a result of long-term conservation in alcohol, specimens from Greenland have faded colours and a strongly swollen gaster, which makes identification rather difficult. Moreover, certain ratios differ from values given by Graham (1969, sub *Eupteromalus* Kurdjumov, 1913) and several important characters were not mentioned by him. Therefore, some of the diagnostic characters are given here for the females from Greenland and the lectotype (values in brackets):

POL 1.56–1.8 [1.78] times OOL; malar space 0.66–0.7 times as long as eye height; eyes separated by 1.4–1.6 times their height; scape about as long as eye height, almost extending to level of vertex; fore wing fully developed; marginal vein 1.48–1.82 [1.56] times as long as stigmal vein. **DISTRIBUTION.** *Trichomalopsis fucicola* is recorded from a single locality, Kapisigdlit in western Greenland. Hitherto known only from Germany (Heitland 1988), Ireland (Graham 1969) and the United Kingdom (Graham 1969, Askew 1974), the species was also reported from Iceland by Bakkendorf (1955) as *Eurydinota leptomera* Förster, 1878 [misidentification].

Tab. 1. List of Eulophidae and Pteromalidae recorded from Greenland; * = first record for Greenland, ! = misidentification

Currently used names	Names used earlier, with reference
Eulophidae	
<i>Aprostocetus meltoftei</i> Buhl	<i>Aprostocetus meltoftei</i> : Buhl 1997
* <i>Chrysocharis pubicornis</i> (Zetterstedt)	
* <i>Closterocerus diastatae</i> (Howard)	
* <i>Diglyphus isaea</i> (Walker)	
<i>Elachertus fenestratus</i> Nees	<i>Elachertus artaeus</i> (Walker) !: Buhl 1997
* <i>Pediobius alaspharus</i> (Walker)	
Pteromalidae	
<i>Ardilea convexa</i> (Walker)	<i>Lamprotatus ?pilicornis</i> Thomson !: Lundbeck 1897, Bakkendorf 1955; <i>Ardilea convexa</i> : Graham 1969
<i>Asaphes hirsutus</i> Gibson et Vikberg	<i>Isocratus vulgaris</i> (Walker) !: Lundbeck 1897; <i>Asaphes vulgaris</i> Walker !: Bakkendorf 1955, Graham 1969
<i>Callimerismus suecicus</i> Graham	<i>Dicychus</i> sp. !: Lundbeck 1897; <i>Sphegigaster</i> sp. !: Lundbeck 1897; <i>Cryptoprymna ater</i> (Walker) !: Bakkendorf 1955
* <i>Glyphognathus laevigatus</i> (Delucchi)	
<i>Pachyneuron groenlandicum</i> (Holmgren)	<i>Pteromalus groenlandicum</i> : Holmgren 1872; <i>Pachyneuron groenlandicum</i> : Lundbeck 1897, Bakkendorf 1955, Hedqvist 1977
<i>Pteromalus</i> sp. near <i>semotus</i> (Walker)]	[?] <i>Pteromalus</i> sens. lat.: Henriksen & Lundbeck 1917; [?] <i>Habroclytus</i> sp.: Bakkendorf 1955
* <i>Seladerma</i> cf. <i>breve</i> (Walker)	
* <i>Seladerma geniculatum</i> (Zetterstedt)	
* <i>Trichomalopsis fucicola</i> (Walker)	

General remarks

In total, six Eulophidae and nine Pteromalidae are recorded from Greenland (Tab. 1). Of these, eight species are recorded here for the first time. Concerning the considerable number of specimens examined, I expect at most a very few undiscovered species. All known species are confined to the ice-free costal areas where they were usually collected during the warmest months of the year, July and August. Most species occur in southern (latitude about 60°N) and western parts of the

Tab. 2. List of species of Eulophidae and Pteromalidae recorded for Greenland and their occurrence in Iceland, Europe, Canada, and the USA (after Noyes 2002); „x“ = present, „–“ = absent, „?“ = doubtful, „i“ = introduced, „NW-Terr.“ = Northwest-Territories (including Nunavut) in Canada

taxa	Greenland	Iceland	NW-Terr.	Europe	Canada	USA
Eulophidae						
<i>Aprostocetus meltoftei</i>	x	–	–	–	–	–
<i>Chrysocharis pubicornis</i>	x	–	x	x	x	x
<i>Closterocerus diastatae</i>	x	–	–	–	x	x
<i>Diglyphus isaea</i>	x	x	–	x	i	i
<i>Elachertus fenestratus</i>	x	–	–	x	x	x
<i>Pediobius alaspharus</i>	x	–	–	x	–	–
Pteromalidae						
<i>Ardilea convexa</i>	x	x	–	x	–	–
<i>Asaphes hirsutus</i>	x	–	x	x	x	x
<i>Callimerismus suecicus</i>	x	x	–	x	–	–
<i>Glyphognathus laevigatus</i>	x	–	–	x	–	–
<i>Pachyneuron groenlandicum</i>	x	–	–	x	–	–
<i>Pteromalus</i> sp. near <i>semotus</i>	x	–	–	–	?	?
<i>Seladerma</i> cf. <i>breve</i>	x	–	–	x	–	–
<i>Seladerma geniculatum</i>	x	x	–	x	–	–
<i>Trichomalopsis fucicola</i>	x	x	–	x	–	–

country. Remarkably, two eulophids, *Elachertus fenestratus* and *Aprostocetus meltoftei*, are known only from northern latitudes, i.e. from Thule (77°28'N) in the north-west, and Zackenberg (74°28'N) in the north-east of Greenland. While *Elachertus fenestratus* is widespread in the Holarctic region (Noyes 2002), *Aprostocetus meltoftei* has not yet been recorded elsewhere.

Because of the arctic climate in Greenland, the fauna of Eulophidae and Pteromalidae is much less diverse compared with warmer regions. However, the number species is comparable to those of the closest landmasses with a similar climate (Tab. 2). For instance, seven Eulophidae and nine Pteromalidae are present in Iceland (Noyes 2002), which is situated to the east of Greenland at a similar latitude (63°26' to 66°31'N). For the Northwest Territories (including Nunavut, Canada) to the west of Greenland, fifteen Eulophidae and five Pteromalidae are listed (Noyes 2002). The total number of species is slightly raised here, probably because the area is connected to the North American continent. Greenland and Iceland, on the other hand, are islands. They have five species in common, whereas only two Greenland species occur in the Northwest Territories (Tab. 2). From table 2 it is furthermore evident, that, beside four Holarctic species, nine species also occur in Europe, whereas only one is present in Canada and the USA. This suggests much stronger connections with the Palaearctic than the Nearctic fauna, which is surprising, because Greenland is usually considered as part of the Nearctic region (Brown et Lomolino 1998).

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The pteromalid genus *Collentis* (Hymenoptera: Pteromalidae) newly reported from the Palaearctic Region

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Abstract. *Collentis* Heydon, 1992 is newly reported from the Palaearctic region with the transfer of *Callimerismus suecicus* Graham, 1969 to *Collentis* as *C. suecicus*, comb. nov. *Collentis* is compared with *Callimerismus* Graham, 1956 and Palaearctic Miscogastrini, and *Collentis suecicus* is compared with *Collentis latipennis* (Ashmead, 1890) from Colorado, USA, the only other known species in the genus.

Distribution, taxonomy, new combination, new record, parasitoid, Hymenoptera, Chalcidoidea, Pteromalidae, Miscogastrini, Palaearctic region

INTRODUCTION

The miscogastrine genus *Collentis* Heydon, 1992 was described for *Dipara latipennis* Ashmead, 1890, a species known only from two localities in Colorado, USA (Heydon & Bouček 1992). The species had previously been transferred to *Callimerismus* Graham, 1956 by Hedqvist (1969), a genus now classified in the Sphegigastrini. Heydon (1989) established that a major difference between the Sphegigastrini and Miscogastrini was the form of the petiolar base. Sphegigastrini have a complete anterior ventral flange, whereas Miscogastrini do not (unsclerotized antero-ventrally). The confusion between *Callimerismus* and *Collentis* was largely because they both have an asymmetrically tridentate clypeus, lack a pronotal collar carina, and have a similarly sculptured prepectus and frenum. Aside from the petiolar flange, the only other stated difference between the two genera is the shape of the posterior margin of the first gastral tergite, which is straight in *Callimerismus* and bisinuate (mesally convex) in *Collentis* (Fig. 2). Another difference between the genera is the sculpture of the propodeum. *Callimerismus* has step-like plicae delimiting raised median panels as in many other sphegigastrines, whereas *Collentis* has much more poorly differentiated plicae and median panels as in many other small miscogastrines. *Callimerismus suecicus* Graham, 1969 was described from a single female specimen collected in Skåne, Sweden (Graham 1969). Upon examining this specimen (BMNH), I concluded that it belongs to the genus *Collentis*.

MATERIALS AND METHODS

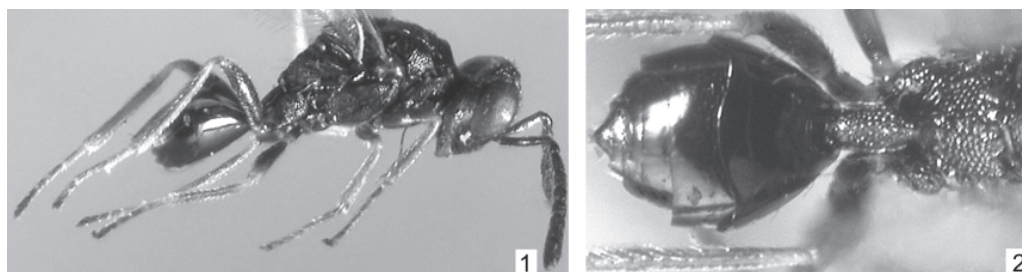
All measurements and terminology follow Graham (1969) except that “prepectus” is used for “postspiracular sclerite”, “alveolate” for sculpture divided into small polygonal cells separated by raised septa, and “coriaceous” for sculpture divided into similar cells but by sunken septa. Abbreviations for museums: (BMNH) The Natural History Museum, London; (USNM) U.S. Natural History Museum, Smithsonian Institution, Washington, DC. Photographs were taken using Auto-Montage software (version 4.04.0128 BETA, Synoptics, Ltd., UK 1997... 2003) through a 3-CCD digital videocamera attached to a stereoscope.

DISCUSSION

Collentis suecicus (Graham, 1969), comb. nov. (Figs 1–2) represents the first record of the genus from the Palaearctic region. It can be distinguished from other Palaearctic Miscogastrini by keying it to *Callimerismus* in Bouček & Rasplus (1991) and then applying the characters outlined above. *Collentis*

differs from many Miscogastrini in having raised (alveolate) mesosomal sculpture and a small stigma as opposed to the sunken (coriaceous) sculpture and grossly swollen stigma of *Miscogaster* Walker, 1833 and similar genera. It is also characterized by a long ($2\times$ longer than broad) petiole, partially bare forewing basal cell, distinct but acarinate pronotal collar, and uniformly alveolate prepectus without a diagonal carina. Particular differences between *Collentis* and similar Palaearctic Miscogastrini are as follows; *Merismus* Walker, 1833 has a carinate pronotal collar and prepectus with a diagonal carina; *Telepsogina* Hedqvist, 1958 has a much shorter, smooth petiole and stouter flagellum in females; and *Thektogaster* Delucchi, 1955 has a much shorter petiole and longer, lanceolate gaster in females.

The two species of *Collentis* are very similar in most respects, but I consider them separate on the basis of a few cranial characters. I examined the specimens of *C. latipennis* in the USNM and found the following differences: head more transverse ($2.3\times$ broader than maximum length in *C. latipennis*, $2.15\times$ in *C. suecicus*); and eyes smaller (distance between eyes $1.9\times$ dorsal eye length in *C. latipennis*, $1.4\times$ in *C. suecicus*; eye length $2.5\times$ temple length in *C. latipennis*, $3.5\times$ in *C. suecicus*). Males and the biology of *C. suecicus* remain unknown, although Heydon (in Heydon & Bouček 1992) speculated that the host would be a leaf- or stem-mining dipteran. The unusual distribution of *Collentis* (Colorado (USA), Sweden) is difficult to explain except through invoking extreme reduction from a previously extensive Holarctic distribution. Examination of collections for additional specimens of both species has proven fruitless so far, but elucidation of the biology of *Collentis* and collections from additional localities should provide a better understanding of the history of the genus.



Figs 1, 2. *Collentis suecicus* (Graham) comb. nov., holotype female; 1 – lateral habitus, 2 – dorsal view of propodeum and metasoma.

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Dispersal of fig wasps (Hymenoptera: Chalcidoidea) across primary and logged rainforest in Sabah (Malaysia)

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Abstract. Selectively logged forests differ from primary forest in species composition and physical structure. Both factors potentially influence the insects that live and disperse within them. Fig wasps (Hymenoptera: Chalcidoidea), which include the pollinators of fig trees (*Ficus* species), are capable of moving between trees several kilometers apart, and previous studies have shown that they predominantly disperse above the canopy of primary forests, taking advantage of the faster wind speeds there. Using arrays of passive sticky traps we examined the flight heights of fig wasps in adjacent areas of primary and logged (secondary) lowland rainforest at Danum Valley, Sabah, Malaysia and also compared the composition of their assemblages. The numbers of wasps trapped were roughly similar, but non-pollinating species were better represented in the primary forest. Amongst the pollinator fig wasps, night-flying pollinators of monoecious fig trees predominated in the primary forest, while diurnal pollinators of monoecious trees were more abundant in the logged forest. Most of the fig wasps were trapped above the canopy in the primary forest, while in logged forest, where a clear cut canopy structure was absent, they were flying closer to the ground. Night- and day-flying species had similar height profiles within the two forest types. The differences between the fig wasp assemblages at adjacent logged and primary forest sites may reflect contrasting local host tree abundance, despite the homogenizing effect of their long-distance dispersal capabilities.

Ecology, altitude, dispersal, *Ficus*, flight, pollination, rainforest, fig wasp, Hymenoptera, Chalcidoidea, Oriental region

INTRODUCTION

Host species-specific fig wasps (Hymenoptera: Chalcidoidea: Agaonidae) are the pollinators of the 700 or more species of fig trees (Moraceae: *Ficus* spp.) (Janzen 1979, Wiebes 1979). Around half the species of fig trees are monoecious, with all trees bearing figs that produce both seeds and pollinating wasps, while the remaining species are functionally dioecious, with trees that produce either seed-producing or wasp-producing figs. Individual fig trees, especially of monoecious species, typically fruit synchronously, with intervals of weeks or months between successive crops. This means that the females of each generation of wasps commonly have to disperse between fig trees if they and their pollinators are to reproduce. In contrast, at the population level fruiting is typically asynchronous and at any one time there are only a small proportion of the trees of any one species that are either releasing pollinators, or waiting to be pollinated. This increases the distances that the pollinators need to travel, as the nearest suitable hosts can be kilometres away from trees that are releasing the wasps. This suggests that fig wasps require exceptional dispersal and host-finding abilities (Compton 2002), and in confirmation of this, recent evidence has shown that desert-living fig wasps can reach trees more than 100 kilometres away from their parent plants (S. Ahmed & S. G. Compton, unpubl.).

Such long distance dispersal between the trees is particularly surprising given the physical characteristics of fig wasps, as the adult pollinators are small, weak-flying insects that do not feed, are prone to dehydration and probably never survive for longer than 48 hours (Compton et al. 1994). There are also non-pollinating species (also belonging to the Chalcidoidea) that must be capable of routine dispersal between fig trees. Their larval biologies are diverse, with some feeding in galled ovules in the same way as the pollinators, while others are parasitoids. These non-pollinating fig wasps have certain advantages relative to the pollinators, in that they may feed as adults, be longer-lived, or may not all be host tree specific (Compton et al. 1994).

For fig wasps to be able to track a resource that is so highly ephemeral and widely dispersed they need to be able to cover large distances quickly and they need to be able to accurately home-in on those hosts which have figs at the correct stage of development. When they are ready to be pollinated, fig trees release species-specific volatiles, which attract their particular pollinators, and no others (van Noort et al. 1989), but because they are so small, fig wasps have low flight speeds, and have no control over their direction of flight once they are in air moving greater than a few metres per second (Ware & Compton 1994a). Based largely on studies in savannah environments (Ware & Compton 1994a, b), Compton (2002) provided a model of how between-tree dispersal may be achieved, given the slow flight speeds and limited longevities of the wasps. This involves an initial passive dispersal phase, involving long-distance down-wind travel within the general air column, followed by a shorter controlled upwind flight, closer to the ground or vegetation, to reach trees that are of the correct species, and have figs at a suitable stage of development.

The densities of strangler (hemiepiphytic) fig trees in rainforests are often particularly low (Mawdsley et al. 1998), yet these monoecious trees produce large, highly synchronised crops that

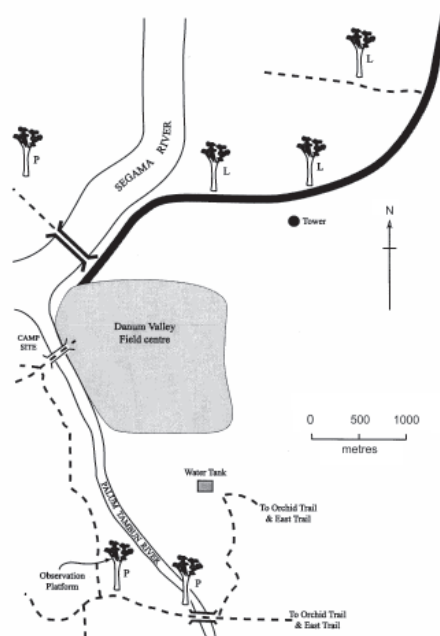


Fig. 1. The locations of trap sites (tree symbols) in primary (P) and secondary (S) forest adjacent to the Danum Valley Field Centre, Sabah.

are able to attract many thousands of pollinating wasps over periods of just a few days (Nason 1996). In rain forest environments, entry into the fast-flowing air above the canopy may provide the means by which long distance dispersal is achieved by fig wasps, followed by descent into the canopy, and below, where wind speeds are lower (Whitmore 1984, Sutton 1989) and controlled flight can be achieved. Descent into the canopy could potentially be in response to the attractants produced by figs in or below the canopy as upward movement of air out of the forest may be quite common (Whitmore 1984, Kira & Yoda 1989).

In a previous study (Compton et al. 2000) we compared the flight heights of fig wasps and other chalcidoids in primary rainforest at Danum Valley in Sabah, Borneo. Most families were represented throughout the range of trap heights, including those above the general canopy, but fig wasps were exceptional in that they were almost entirely trapped above the canopy. These included species associated with host trees that fruit low in the forest, suggesting that they actively fly up above the canopy as part of their dispersal strategy. Using similar techniques elsewhere in Borneo, Harrison (2003) has nonetheless shown that pollinators of dioecious figs are relatively poorly represented in traps placed above the canopy, implying that not all fig wasps disperse there.

As elsewhere in Borneo, South-east Asia and beyond, the rainforests of Borneo are being rapidly logged and cleared. In Sabah, primary forest is effectively restricted to protected areas, with the rest of the country comprising areas of secondary (logged) forest, and, increasingly, plantations. Forest fragmentation and disturbance will clearly have an impact on the ability of fig wasps to disperse between fig trees. Fig trees are often regarded as representing “keystone resources” in tropical forests (Terborgh 1986) because of their all-year-round production of figs, often in large quantities, which can maintain frugivore populations at times when other fruits are not available. If forest fragmentation leads to fewer figs being pollinated, then fewer figs will be available for eating (Mawdsley et al. 1998, Harrison 2003). Furthermore, in Bornean forests at least, different fig trees support different frugivore assemblages, depending on how the figs are presented (Shanahan & Compton 2001). Any disturbance that changes either the abundance or species composition of fig tree assemblages will therefore have consequences for frugivorous animal species.

In this study, passive sticky traps positioned at various heights within primary and secondary rainforest were used to examine the impact of logging on the composition of fig wasp assemblages and the heights at which they fly. The results are discussed in terms of their impact on the pollination of fig trees and the wider consequences for the animals which feed on figs.

METHODS

Trapping was carried out adjacent to the Danum Valley Field Centre (Malaysia: Sabah) in June and July 1999. Rainfall locally averages a little under 3 m a year, and is relatively aseasonal although there are often drier periods around April and September (Marsh & Greer 1992). The field centre is situated at the eastern boundary of the Danum Valley Conservation Area, which comprises 480 km² of undisturbed rainforest. It is adjacent to a large area of selectively logged forest which, like the conservation area, forms part of the concession owned by the Sabah Foundation (Yayasan Sabah). The primary forest adjacent to the field centre is lowland evergreen dipterocarp forest with a canopy surface that is rather irregular, with numerous emergents (Newbery et al. 1992). The logged forest would initially have been similar in composition, but selective logging removes the large, commercially valuable timber species and also causes extensive damage to non-target species (Heydon & Bulloh 1997). The logged forest near the field centre consists largely of secondary regrowth, with *Koompassia* (Leguminosae) the only remaining tall trees. The secondary forest immediately to the north of the field centre was logged in 1989.

We monitored flying fig wasps using traps suspended from three trees in the primary forest (numbered P1–P3) and three in the logged forest (S1–S3, Fig. 1). We found no fig trees releasing wasps in the vicinity of the traps, based on thorough searches within approximately 100 metres of each trap site and less thorough searches over larger areas. Most of the lines supporting the traps were shot over branches using a crossbow (Ellwood & Foster

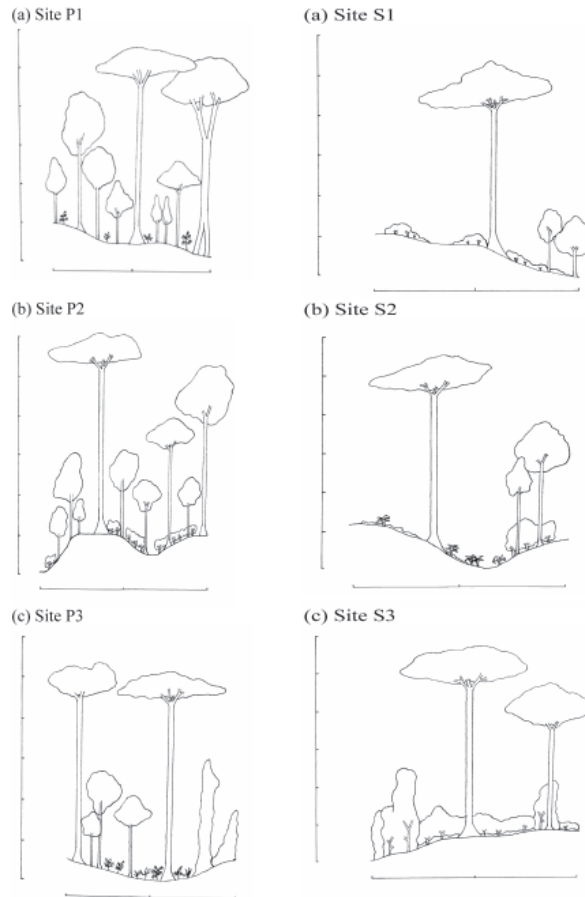


Fig. 2. Vegetation profile diagrams of the six trap locations; (a) – site P1, (b) – site P2, (c) – site P3, (d) – site S1, (e) – site S2, (f) – site S3; note vertical compression: both vertical and horizontal scale intervals equal 10 m.

2001), but P1 was suspended from a canopy observation platform as used previously by Compton et al. (2000). At each trap site, five cylindrical traps (diameter 14 cm, length 90 cm) were suspended vertically at 0, 10, 20, 30 and 40 metres above the ground. Each trap comprised six A4 clear acetate sheets attached to wire mesh frames that were covered with Oecotac® insect trapping adhesive. The adhesive and underlying plastic were shiny, rather than totally transparent. Each trap was topped with a rain guard and the ropes were attached so as to allow the traps to be lowered to ground level when required for examination.

A Bushnell Yardage Pro 400 laser range-finder was used to estimate the heights of the vegetation in the areas surrounding the traps. Primary forest canopy structure was irregular, but the upper two traps were consistently positioned in the overstory, above the general canopy, but below the emergent trees, while the remaining traps were within and below the canopy. Site P1 was situated in riverine forest alongside the Danum Valley nature trail, about 500 m from a tributary of the Segama River. The main canopy was dense, reaching to approximately 30 m, with numerous emergents ascending above this to approximately 50m (Fig. 2a). Site P2 was located nearby, inside a bend in the tributary, which at its closest was about 3 m from the base of the tree. Consequently, the site was more open than P1, and the ground sloped more sharply (Fig. 2b). General canopy height was estimated at about 18 m. Site P3 was located on the west bank of the Segama River, about 100 m along West Trail 1.2 (Fig. 1). Vegetation locally was generally dense, with numerous emergents and a general canopy height of around 25 m (Fig. 2c).

Traps located in the logged forest were suspended from the only remaining emergents (*Koompassia* trees). No general canopy had reformed at the sites, and all but the ground-level traps were above the vegetation in the areas immediately surrounding the trap sites. The nearest of the three secondary (logged) forest sites to the primary forest (S1) was located about 2 km from site P3, down slope from the field centre access road. The trees in the area were widely dispersed with only a few individuals greater than a few metres in height, and most of the vegetation only reaching about 2 m (Fig. 3a). Site S2 was around 1 km east of S1, and also down slope from the road (Fig. 3b). Only low-growing vegetation was present around the base of the tree, but some adjacent trees reached 11 m. Site S3 was located alongside an elephant track about 200 m from S2. Regrowth around the base of the tree was dense, with numerous creepers (Fig. 3c). Some adjacent trees reached approximately 12 m in height.

We started the trapping in the primary forest in early June and all the traps were removed after having been suspended for 19 days. The effectiveness of the adhesive was checked periodically and renewed if necessary. Individual acetate sheets were inserted inside clear plastic bags for transport and subsequent examination using a binocular microscope. Fig wasps that required more detailed study were removed from the acetate sheets, treated in n-heptanal to remove the adhesive (Henshaw 1993), relaxed in water and then glued on to card points. Taxonomic placement followed Bouček (1988).

Wind speeds are generally slight beneath the rainforest canopy, but increase progressively with height above the canopy (Sutton 1989). The numbers of fig wasps trapped on the acetates at different heights are therefore not true indicators of densities per unit volume of air, but represent the numbers of wasps passing through the areas 'sampled' by the traps. Because of the more rapid air movement above the general canopy, more air will come into contact with the traps there. The flight heights of the fig wasps collected on the traps could not be related directly to the heights of the figs they pollinate, because the host relationships of most of the species are unknown and many remain undescribed. Indirect comparisons are nonetheless possible for the pollinator fig wasps, using the breeding systems of their host plants. These are readily distinguishable, because those wasps that pollinate monoecious *Ficus* species have considerably longer ovipositors than those associated with dioecious hosts. Strangler fig trees, with their figs placed high in the canopy, are monoecious, whereas dioecious species mainly (but not exclusively) produce their figs at lower levels. The diel flight activity of the pollinators can also be determined, based on their colouration and the size of the eyes. The general appearance (facies) of nocturnal (and crepuscular) species have a paler colouration and larger eyes (Compton et al. 2000) compared with the darker brown and smaller eyes of day-flying species.

RESULTS

Faunal comparisons

Approximately two thousand fig wasps were collected on the sticky traps during the 19 day sampling period (Tab. 1), with the numbers of individual wasps trapped at each site ranging from 168 (site P1) to 765 (site P2). Overall there were roughly similar numbers of fig wasps collected in the primary and secondary forest, but the compositions of the fig wasp faunas were different,

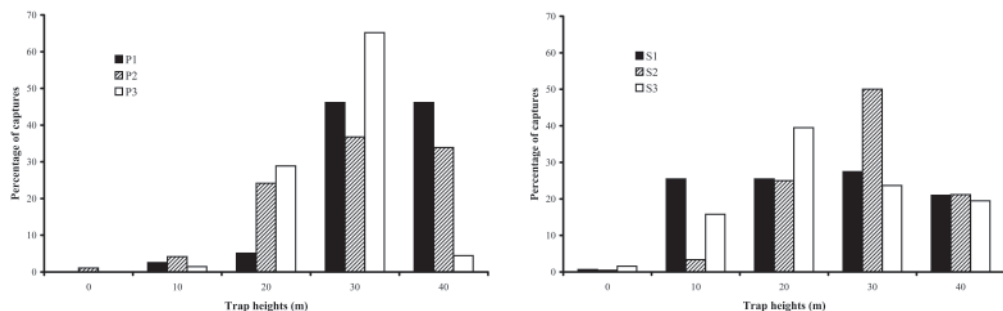


Fig. 3. (a) – the proportion of pollinator fig wasps trapped at different heights above the ground at three sites located in primary forest (P1–P3); (b) – the proportion of pollinator fig wasps trapped at different heights above the ground at three sites located in secondary forest (S1–S3).

Tab. 1. Captures of pollinating and non-pollinating fig wasps on sticky traps at sites in primary and logged forest at Danum Valley Field Centre, Sabah

site	pollinators	non-pollinators	% non-pollinators	total
primary forest				
P 1	117	51	30.4	168
P 2	555	210	27.5	765
P 3	135	76	36.0	211
total	807	337	29.5	1144
secondary (logged) forest				
S1	448	45	9.1	493
S2	208	28	11.9	236
S3	190	42	18.1	232
total	846	115	12.0	961

despite the relative proximity of the trap sites. Non-pollinators were better represented in primary forest, where they represented about 30% of the total fig wasps, compared with only 12% in the logged forest (Tab. 1).

Five subfamilies of non-pollinating fig wasps were recorded, with epichrysomallines particularly well represented, especially at the primary forest sites where they formed around 75% of the total (Tab. 2). Of the five subfamilies of non-pollinators, only the Sycoryctinae is known to include species that are known to be parasitoids that attack the larvae of pollinating fig wasps. These were far outnumbered by representatives of the other subfamilies, all of which, so far as is known, are gallers of fig seeds and ovules (for example Compton & van Noort 1992).

Tab. 2. The numbers and taxonomic representation of non-pollinating fig wasps captured on sticky traps in primary and logged forest

site	Epichrysomallinae	Otitesellinae	Sycoryctinae	Sycoecinae	Apocryptophaginae
primary forest					
P 1	20	2	26	3	0
P 2	167	26	6	10	1
P 3	67	8	1	0	0
total (%)	254 (75.4)	36 (10.7)	33 (9.8)	13 (3.9)	1 (0.3)
secondary (logged) forest					
S1	13	19	11	2	0
S2	16	3	4	4	1
S3	17	13	9	2	1
total (%)	46 (40.0)	35 (30.4)	24 (20.9)	8 (7.0)	2 (1.7)

A majority of the pollinator fig wasps were associated with monoecious host trees in both the primary forest (73.1%) and the secondary forest (69.3%, Tab. 3). The predominant flight periods differed between the two habitats however, with nocturnal fig wasps the more common group in the primary forest, but in a minority in the logged forest (Tables 3 and 4). Pollinator fig wasps with nocturnal flight activity and monoecious host trees were by far the most common combination among the wasps trapped in the primary forest. In contrast, diurnal pollinators of monoecious trees were the most numerous group among the wasps trapped in the logged forest, with combinations other than nocturnal pollinators of dioecious species also well represented. In both forest

Tab. 3. Flight periods (nocturnal or diurnal) and host tree breeding systems (monoecious or dioecious) of pollinating fig wasps based on their morphological characteristics. The host breeding systems of 17 damaged individuals could not be determined (“uncertain”)

	nocturnal		diurnal		nocturnal uncertain	diurnal uncertain
	monoecious	dioecious	monoecious	dioecious		
primary forest						
P 1	45	9	27	35	1	0
P 2	320	80	92	61	2	0
P 3	65	6	37	25	1	1
total	430	95	156	121	4	1
secondary (logged) forest						
S1	97	14	228	102	2	5
S2	61	13	74	60	0	0
S3	50	7	68	60	1	4
total	208	34	370	222	3	9

types the proportion of wasps with diurnal flight activity was far more common among species associated with dioecious host species than those associated with monoecious hosts (Tab. 4).

Flight heights

The numbers of pollinator fig wasps trapped at different heights varied significantly among the three trap sites located in the primary forest and also among the three sites located in the logged forest ($X^2_{[6]} = 82.7$, $P < 0.001$ and $X^2_{[6]} = 73.4$, $P < 0.001$ respectively; captures at 0 and 10 metres were combined because of low cell counts). Few pollinator fig wasps were trapped at ground level and at 10 m in the primary forest, and most were captured above the canopy, at 30 m and above (Fig. 3a). Fewer, or about the same number of individuals, were captured at 30 m compared with 40 m, despite the faster air flow to which the 40 m traps will have been exposed, suggesting that aerial densities are likely to have been higher at 30 m, just above the canopy, than at 40 m. No pollinators were captured at ground level in the logged forest, where there was a much denser ground flora than in the primary forest, but the proportions captured at 10 m were generally higher than those recorded in the primary forest (Fig. 3b). Captures on the traps were most frequent at 20 or 30 m at two of the logged forest trap sites, while at the third site (S1) the numbers trapped were roughly similar across the height range from 10 to 40 m.

Tab. 4. Nocturnal and diurnal pollinators associated with monoecious or dioecious host trees. The host trees of “uncertain” specimens could not be established

host trees	nocturnal	diurnal	% nocturnal
primary forest			
monoecious	430	156	73.4
dioecious	95	121	44.0
uncertain	4	1	80.0
total	529	278	65.6
secondary (logged) forest			
monoecious	208	370	36.0
dioecious	34	222	13.3
uncertain	3	9	25.0
total	245	601	29.0

Tab. 5. Capture heights of day- and night-flying pollinating fig wasps

location	night				day				X ²	D. F.	P
	0&10 m	20 m	30 m	40 m	0&10 m	20 m	30 m	40 m			
P 1	1	0	24	30	2	6	30	24	7.27	3	0.06
P 2	18	114	141	129	11	20	63	59	14.78	3	0.002
P 3	1	19	48	4	1	20	40	2	0.82	3	0.84
S1	51	29	21	12	66	85	102	82	33.37	3	<0.001
S2	2	20	41	11	6	32	63	33	3.40	3	0.33
S3	13	18	13	14	20	57	32	23	3.72	3	0.29

Flight above the canopy during the day exposes fig wasps to more extreme temperatures than they would experience within the forest. It might therefore be expected that night-flying species would be more likely to be trapped above the canopy than day-flying species. Because of the heterogeneity between sites within forest types, comparisons of the flight heights of different sub-groups of pollinators were carried out on a tree by tree basis. Frequencies of day- and night-flying pollinator fig wasps were significantly different with respect to height at several of the sites (Tab. 5), but there was no consistent trend for one or other group to be better represented on the higher traps. Overall, the day-flying and night-flying fig wasps had very similar trap height profiles in both forest types (Figs 4a, b). Similarly, pollinators associated with dioecious host plants, many of which produce figs that are located beneath the canopy, were not consistently better-represented at the lower trap heights than the pollinators of monoecious fig trees, most of which are stranglers that fruit in the canopy (Tab. 6, Figs 5a, b).

Tab. 6. Capture heights of fig wasp pollinators with monoecious and dioecious host trees

location	monoecious hosts				dioecious hosts				X ²	D. F.	P
	0&10 m	20 m	30 m	40 m	0&10 m	20 m	30 m	40 m			
P 1	1	0	37	34	2	6	16	20	12.24	3	0.01
P 2	18	107	148	139	11	27	54	49	4.57	3	0.21
P 3	1	27	69	5	1	11	18	1	1.95	3	0.58
S1	89	77	95	64	28	33	26	29	3.7	3	0.29
S2	2	32	71	30	6	20	33	14	6.57	3	0.09
S3	18	50	25	25	14	25	17	11	1.88	3	0.60

Individual taxa

At least 40 distinguishable species of fig wasp pollinators were present on the traps, and assuming that each species of *Ficus* has one species of pollinator associated with it, then this represents around 30% of the total number of species that are expected to be present in the whole of Borneo. The poor condition of the specimens after extraction from the glue, in combination with the very small differences between many fig wasp species (many of which are undescribed), made it impossible to routinely assign the fig wasps to species level. Three of the more abundant and distinctive taxa were nonetheless distinguished (Tab. 7). As with the fauna as a whole, there was considerable variation in the numbers of each taxon recorded between individual trees, but their relative abundance was similar in the primary and secondary forest. Despite differences in their host trees and flight times (Species One was a night-flying species associated with a monoecious host tree, Species Two was also nocturnal, but with a dioecious host, while Species Three was diurnal, with a monoecious host), the flight height profiles of the three species were largely similar in both the primary and secondary forest. The most frequent trapping height for Species Two was nonetheless unusually close to the ground (10 m) in the secondary forest, but not the primary forest (Figs 6a, b).

DISCUSSION

Logged forests are an increasingly important refuge for wildlife in states such as Sabah, where primary forest cover has been greatly reduced. The relatively careful logging that has taken place around Danum Valley Field Centre has resulted in a forest that, while lacking the grandeur of the primary forest, is nonetheless a significant resource for many species, including rarities such as Asian elephants. Similarly, the suitability for invertebrates of the logged forest appears to vary

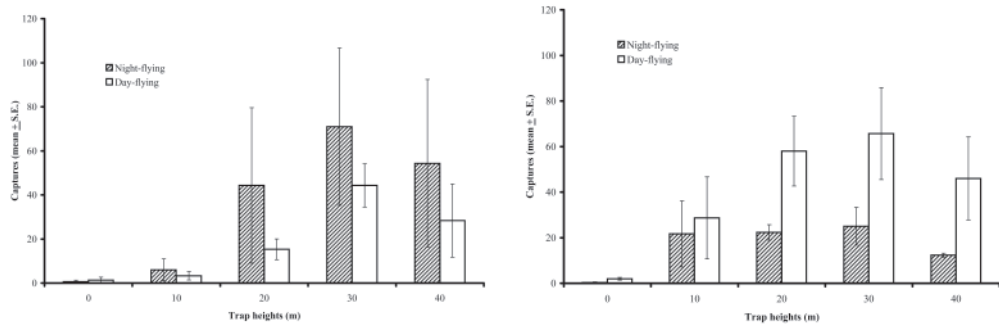


Fig. 4. (a) – the numbers of night- and day-flying pollinator fig wasps trapped at different heights above the ground in primary forest (three sites combined); (b) – the numbers of night- and day-flying pollinator fig wasps trapped at different heights above the ground in secondary forest (three sites combined).

according to the taxon (Davis & Sutton 1998, Willott et al. 2000) with some species faring better in logged forest than others. Logging directly influences rainforest fig wasps by changing the abundance of their host plants (large strangler figs tend to be destroyed during logging operations, while species associated with disturbance, such as some geocarps, appear to be favoured). The question addressed in this paper was whether logging also influences fig wasps indirectly, by changing the physical structure of the forest through which they must travel to find suitable host trees.

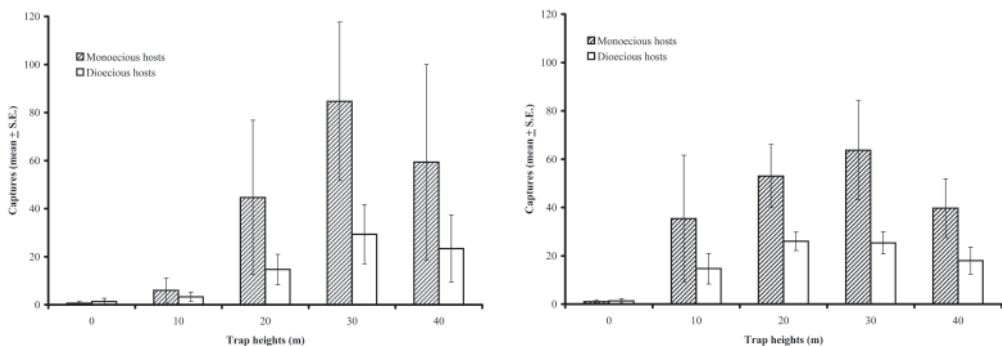


Fig. 5. (a) – the numbers of pollinator fig wasps associated with monoecious or dioecious host trees trapped at different heights above the ground in primary forest (three sites combined); (b) – the numbers of pollinator fig wasps associated with monoecious or dioecious host trees trapped at different heights above the ground in secondary forest (three sites combined).

Daily capture rates of the fig wasps were considerably higher than those during a previous study at Danum Valley (Compton et al. 2000), possibly because the earlier studies were carried out shortly after a major drought period in northern Borneo that had a considerable impact on fig tree fruiting (Harrison 2000). There were gross differences in the fig wasp faunas trapped in the logged and primary forest, most notably the much higher proportion of non-pollinators collected at the primary forest sites. Amongst the pollinator fig wasps, night-flying pollinators of monoecious fig trees predominated in the primary forest, while diurnal pollinators of monoecious trees were more abundant in the logged forest. Whether these differences reflect the relative abundance of their host trees in the two forest types is unknown, but differences in trap composition over such small spatial scales are perhaps surprising, given the great distances traveled by the wasps, which might be expected to have a homogenizing effect on the faunas encountered at nearby locations. Such differences in the composition of fig wasp faunas between primary and secondary forests, if not a purely local or transient phenomenon, will have implications for the reproductive success of the fig trees as pollinator arrival rates at trees are likely to be affected, as will seed losses to non-pollinators.

The results obtained here agree with previous studies showing that many primary rainforest pollinator fig wasps journey above the canopy before arriving at host trees (Compton et al. 2000, Harrison 2003). Small numbers of some species associated with dioecious host trees were nonetheless only trapped at or near ground level, as shown by Harrison (2003) elsewhere in Borneo, suggesting that they employ a different dispersal strategy. Daytime physical conditions above the canopy are harsher than below, with higher temperatures and lower humidities. Perhaps related to this, diurnal flight facies were predominant among the pollinators of dioecious species, in contrast to the mainly nocturnal facies shown by the pollinators of monoecious fig trees. Night- and day-flying pollinator species as a whole nonetheless had similar height profiles within the two forest types, and there were no clear-cut differences between the flight profiles of the three individual species that were monitored, despite their differing hosts or flight times.

The secondary forest lacked a clear cut canopy structure, and in response to this the fig wasps were found to be traveling much closer to the ground. At one of the secondary forest sites roughly equal numbers of pollinator wasps were present on traps within the range of 10–40 metres, while roughly equal numbers were trapped between 20–40 metres at the other two sites. Given that wind speed increases with altitude, this suggests that in the secondary forest aerial densities of the wasps were probably highest just 10–20 metres above the ground.

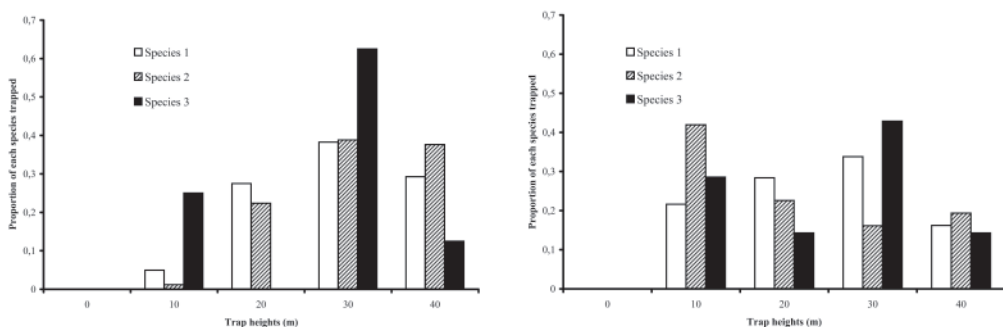


Fig. 6. (a) – the heights at which three pollinator fig wasp species were trapped in primary forest (three sites combined); (b) – the heights at which the same three pollinator fig wasps were trapped in secondary forest (three sites combined).

Tab. 7. Capture locations of three individual taxa of pollinator fig wasps

location	taxa of pollinator fig wasps		
	species 1 (nocturnal, with monoecious host tree)	species 2 (nocturnal, with dioecious host tree)	species 3 (diurnal, with monoecious host tree)
P 1	18	6	1
P 2	182	74	2
P 3	22	5	7
P total	222	85	10
S1	32	14	5
S2	24	11	0
S3	18	6	2
S total	74	31	7

Fig wasps are typical of other small insects that utilize fast moving air for dispersal (Compton 2002) and their modified flight height profiles in logged forest may well be replicated by small insects in general, with implications beyond fig trees and their host trees. Dispersing fig wasps are often highly abundant in tropical forests, contributing, for example, 84% of all the canopy insects collected at light in Sarawak by Kato et al. (1995) and one third of all the food items collected by the edible-nest swiftlet (*Aerodramus fuciphagus*) in peninsular Malaysia (Langham 1980). Behavioural responses amongst predators on “aerial plankton” are therefore to be expected.

Acknowledgements

Back in 1980 or early 1981, a doctoral student interested in chalcids was planning his first trip to the tropics and sought advice at what was then the British Museum (Natural History Museum London). Fortunately for him, Zdeněk Bouček suggested that there was much to be done with fig wasps, particularly the non-pollinators. Almost 25 years later, the senior author would like to express his gratitude to Zdeněk, and to concur with his assessment.

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The world species-groups of *Leucospis* (Hymenoptera: Leucospidae) – – thirty years later

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Abstract. The morphological characters used in an interactive identification key to the world species-groups of *Leucospis* Fabricius, 1775 were analyzed phylogenetically to evaluate both the monophyly and relationships of the species-groups of *Leucospis*. There was considerable homoplasy in the diagnostic characters and the majority of the species-groups are only weakly supported by the cladistic analysis. An interactive identification key was used to diagnose the species-groups in each of the world's major biogeographic regions. Based on these diagnoses and the results of the cladistic analysis, a modification to Bouček's (1974) system of species-groups is proposed: subdividing the *Leucospis pediculata* species-group into two putatively monophyletic species-groups, the *L. pediculata* species-group (revised composition) and the *L. micrura* species-group. The use of informal species-groups, as advocated by Bouček, as opposed to poorly substantiated genera or subgenera, is a pragmatic approach to infra-generic classification. New initiatives in taxonomy for the twenty-first century are discussed and the suggestion is made to have Bouček's (1974) revision be the new starting point for the taxonomy of the Leucospidae.

Taxonomy, phylogenetics, species-groups, interactive key, Hymenoptera, Chalcidoidea, Leucospidae, world-wide

INTRODUCTION

It has been 30 years since Zdeněk Bouček published the first and only species level revision for a major family level taxon in the Chalcidoidea. A Revision of the Leucospidae (Hymenoptera: Chalcidoidea) of the World (Bouček 1974) was and remains a monumental work: 272 figures were included; 109 species were recognized and keyed, 31 of which were new; 2 generic and 58 specific and subspecific names were synonymized; and 5 new combinations were proposed. Because of their large size and interesting color patterns these wasps attracted considerable early attention; as a result the classification of this family was incredibly complicated and confused, even for Chalcidoidea. Synonymy was rampant, and resolving the nomenclature required Bouček to examine the type material for more than 150 names (including 57 holotypes) and to designate 91 lectotypes. The vast majority of species were referred to *Leucospis* and the most recent list of valid names includes 114 species. Remarkably, only 6 species of *Leucospis* have been described since the 1974 revision, and Bouček was an author of two of these species (references available in Noyes 2004). Furthermore, all of the more recent authors have described their species in the context of Bouček (1974), even when the first fossil species was described (Engel 2002).

Bouček struggled with a way to organize the more than 100 morphologically-diverse species of *Leucospis* known at the time. He eventually abandoned the idea of several genera, or even subgenera, and settled on an infra-generic classification based on species-groups and species sola. This had the advantage of not further complicating the nomenclature and this flexible system of classification has been recommended and used in other complex genera of Chalcidoidea (e.g., *Eupelmus* Dalman, 1820 by Gibson 1995; *Perilampus* Latreille, 1809 by Darling 1996). The last 30 years has seen the development of a more explicitly phylogenetic approach to taxonomy and systematics. Today's species-groups should either be arguably monophyletic or if not it should be clearly stated that these groupings are ones of convenience and do not necessarily reflect the evolutionary history of the group.

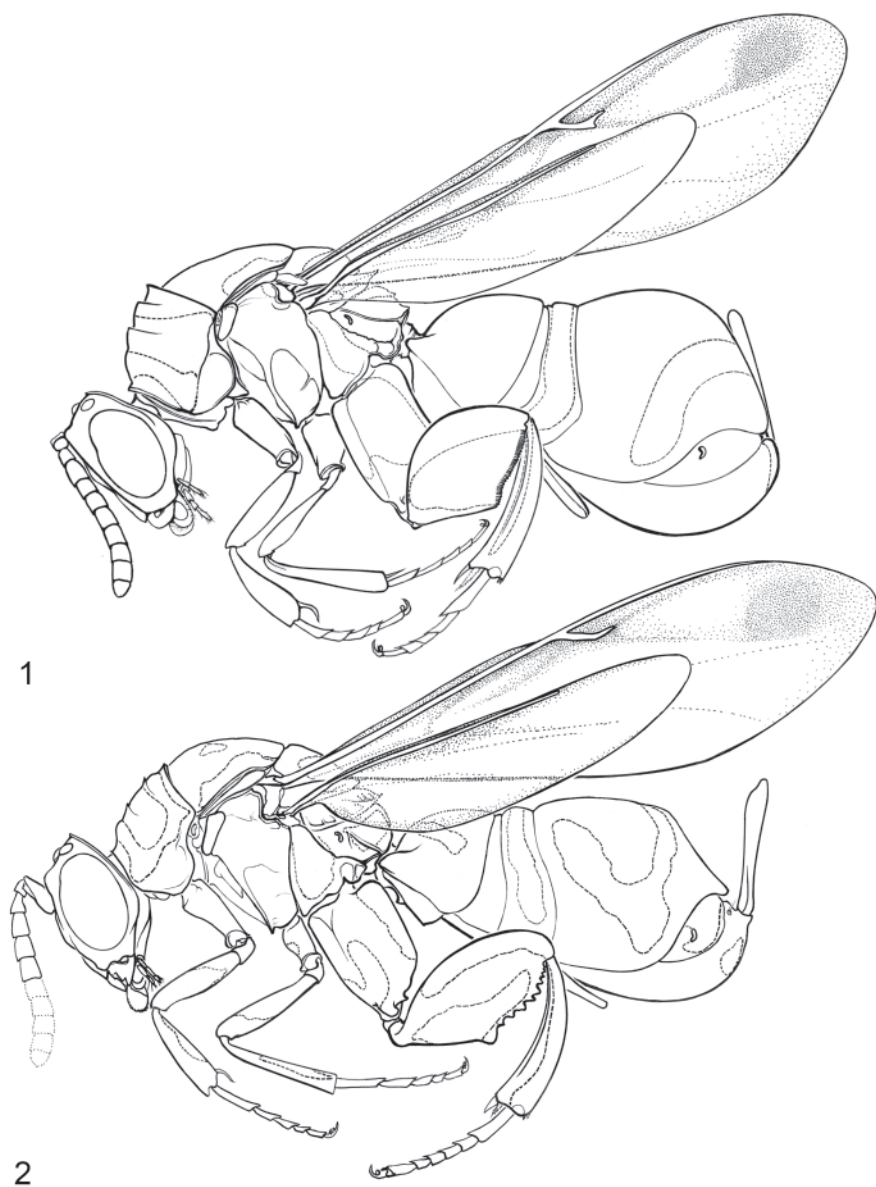
In this 30-year update to the taxonomy of *Leucospis* we: 1) use an interactive identification key to diagnoses the species-groups of *Leucospis* by geographic region and 2) use a subset of the character states in the interactive key to explore the phylogenetic relationships of the species of *Leucospis*, specifically the monophyly of the species-groups and also the relationships among the species-groups. Finally, we briefly discuss radical and progressive initiatives aimed at revitalizing taxonomy and suggest how these might be applied to *Leucospis* and the Leucospidae as recognition of a truly monumental work in chalcidoid taxonomy.

METHODS

Lucid© (see www.lucidcentral.com) was used to prepare an interactive identification key to the world species-groups of *Leucospis* (Cardinal & Darling 2003, 2005). We prepared a Lucid Builder (ver. 2.3) database of species, species-groups and characters using Bouček (1974) as the starting point. Table 1 provides a current summary of the number of species in each species-group or species sola and their geographic distributions (see also Noyes 2004). The only modification from Bouček (1974) involves the *Leucospis pediculata* species-group, which is partitioned into the *L. pediculata* species-group (*sensu stricto*) and the *L. micrura* species group. For each of 70 species available for study, a total of 36 morphological characters were coded along with information on geographic distribution. A composite species-group taxon was then added using all of the character states of the included species. This working database was then used with Lucid Player Plus (version 2.2) to identify unknown specimens and to evaluate the usefulness of the species-groups. This allowed for fine tuning the morphological characters and provided diagnoses for species-groups and species sola. The current species-group key (16 species-groups, 4 species sola) is available on the Lucid website (www.lucidcentral.com) and the species-group diagnoses are derived from this interactive key.

Databases were exported using the Lucid translation wizard and the DELTA Editor (Dallwitz et al. 1999) was used to produce a Nexus file which can be used in a variety of phylogenetics programs. We used Winclada (ver. 1.00.08) (Nixon 1999-2002) and NONA version 2.0 (Goloboff 1999) as a matrix editor/cladogram viewer/printer and tree-searching program, respectively. Two matrices were evaluated and the 37 identification characters were reduced to 32 characters by removing finely differentiated sculpture characters (n=3), an intergrading character (lower face, shape), and the character coding for geographic distributions (See Appendix 1 and 2). *Polistomorpha* Westwood, 1839 and *Micrapion* Kriechbaumer, 1894 were coded as outgroup taxa. The monotypic genus *Neleucospis* Bouček, known only from the holotype female, was not included in this study, either as an ingroup or an outgroup taxon (see Bouček 1974 for a discussion of the affinities of this genus, which is close to *Leucospis*). The species matrix consisted of 70 species and the 2 outgroup taxa and was used to determine whether or not the species-groups are "natural" groups (taxa) or units of convenience. The species-group matrix consisted of 20 taxa (16 species-groups and 4 species sola) and was used to test both composition and relatedness of the species-groups. All characters were treated as unordered and unweighted and both the Heuristics and Ratchet (Nixon 1999) options of NONA were used to find the shortest trees. Global Bremer support (Bremer 1988) was determined using TreeRot (Sorenson 1999).

There are a number of methods for coding and sampling higher-level taxa for phylogenetic analysis (Wiens 1998, Simmons 2001). Two were used in this study: 1) species-as-terminals and 2) higher taxa (species-groups in this case) as terminals and coding interspecific variation as polymorphisms (ambiguity coding). Both analyses are necessarily preliminary and are based on a relatively few easily observable identification characters. Our intent is not to resolve the issue of species-groups in *Leucospis* but rather to provide a starting point for a critical reanalysis and also to show how Lucid databases can be used as more than interactive identification keys.



Figs 1, 2. Habitus drawings. 1 – undescribed species in the *Leucospis pediculata* species-group from Indonesia; 2 – undescribed species in the *Leucospis micrura* species-group from Thailand.

RESULTS

Cladistic analysis of the species-groups of *Leucospis*

The species-groups of *Leucospis* proposed by Bouček (1974) are only weakly supported by the phylogenetic analysis of the 70 species. Both the heuristics and ratchet analyses produced an indeterminate number of equally parsimonious trees of length = 52 (Ci = .31, Ri = .78). Five combined heuristics analyses with max trees = 100, number of replicates = 10, starting trees per rep = 1 (100/10/1) produced 500 trees of length 152; the same 500 trees were obtained using the parameter values 100/10/10. And a single analysis using 1000/100/10 produced 1000 trees of length 152. The strict consensus trees were the same in all three species-as-terminals analyses and the topology is more conservative but otherwise similar to results of the species-groups analysis (see Fig. 3). The following four species-groups were monophyletic on the consensus trees and supported by uniquely derived autapomorphies: *L. cayennensis*, *L. affinis*, *L. texana*, and *L. pediculata* (s. str.). These species-groups are all relatively small or were represented by relatively few species in this study (3 of 9, 2 of 4, 2 of 3, and 5 of 5, respectively). The following three species-groups were also monophyletic on the consensus trees but supported only by characters exhibiting homoplasy: *L. australis* (2 of 5 examined), *L. tricolor* (2 of 4), and *L. gigas* (3 of 6). There were two distinct clades of *L. elegans* group species (13 of 19 species examined) but the *L. petiolata* (5 of 7), *L. speifera* (6 of 12), *L. hopei* (4 of 9), *L. egaia* (7 of 9) and *L. dorsigera* (4 of 7) groups were not resolved.

Fig. 3 is the strict consensus tree for the species-groups analysis with interspecific variation coded as polymorphisms. Six equally parsimonious trees (length = 88, Ci = .53, Ri = .63) were produced by the heuristic analysis. A ratchet analysis, sampling 3 characters for 200 replicates, found 8 trees of 88 steps and the same consensus tree was produced (Fig. 3). Fast optimization of characters is depicted to maximize support for relationships between species-groups; in the discussion that follows, numbers separated by a slash (/) refer to characters and states, respectively (Appendix 1). The species-groups with long ovipositors (*L. dorsigera* species-group and those below) are supported by 3 synapomorphies (27/3, 28/3, 29/2). However, two of these characters are almost certainly not independent (27, 28) and there is polymorphism within the species-groups for each of these characters. Only two clades were supported unambiguously, that is by unique and unreversed synapomorphies, without polymorphism within the species-groups: *L. texana* + *L. tricolor* (16/1, very small basal tooth on hind femur; 19/5 outer spur on hind tibia a recurved hook); *L. australis* + *L. regalis* (12/2, dorsal edge of hind coxa elongate and narrow). Other possible synapomorphies (11/1, 19/3, 23/1) are problematic because of polymorphisms within the species-groups. Other relationships are tentatively supported by sets of homoplasious characters (e.g., *L. antiqua* + *L. aruina*, *L. petiolata* + *L. fuelleborniana* + (*L. texana* + *L. tricolor*), and *L. cayennensis* + *L. egaia* + *L. speifera*). The overall low level of nodal support for the relationships of the species-groups is confirmed by the Bremer analysis; only 3 sister group relationships have Bremer support values > 1 (*L. texana* + *L. tricolor*, *L. australis* + *L. regalis*, *L. antiqua* + *L. aruina*) and in each case the value is only 2.

A review of the species-groups of *Leucospis*

The following is a summary of the morphological characters that can be used to diagnose the species-groups of *Leucospis* found in the various biogeographic regions. Information is also provided concerning the possible monophyly of the various species-groups by identifying putative autapomorphies (Fig. 3). Illustrations and photographs of all the characters and species discussed below are available in the Lucid identification key (Cardinal & Darling 2005). The following diagnoses are based on characters that we found particularly reliable in referring species to species-groups. The Lucid identification key provides additional characters (we have relied on

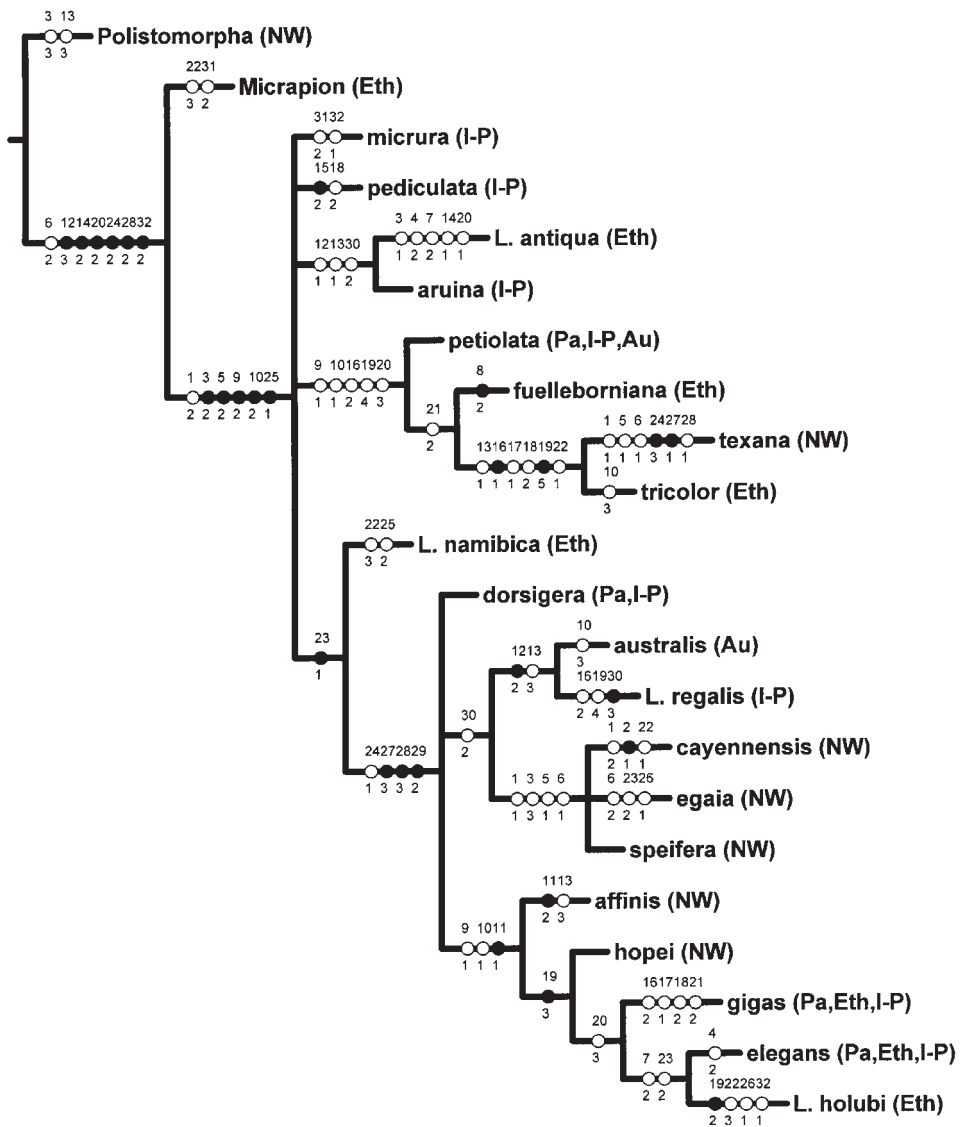


Fig. 3. The phylogenetic relationships of species-groups and species sola of *Leucospis* Fabricius. Consensus tree of 6 equally parsimonious trees (length = 88, Ci = .53, Ri = .63) produced by a heuristic analysis of the data matrix in Appendix 2. See text for discussion. Closed circles, unique and unreversed changes, synapomorphies and autapomorphies; open circles, homoplasious changes, convergences and reversals. Biogeographic regions indicated in brackets: NW, New World; Pa, Palearctic; Eth, Ethiopian; I-P, Indo-Pacific; Au, Australian.

only 25 of the 32 characters) and many of the other characters or combinations of characters are useful when dealing with restricted sets of species-groups, particularly when accompanied by the illustrations and photographs in the key. Freedom to use a variety of characters in various order and combination is one of the main advantages of interactive keys such as Lucid (Snow & Sharp 1999). There are no species-groups shared by the New World and the Old World. Six species-groups are restricted to the New World and 3 have species in both the Nearctic and Neotropical regions; the other 3 species-groups are exclusively tropical (Table 1). There is no evidence that the New World species are monophyletic (Fig. 3). Six of 10 Old World species-groups are restricted to single regions (Table 1). The *L. elegans* and *L. gigas* species-groups are widely distributed and found in the Ethiopian, Palearctic and Indo-Pacific regions, whereas the *L. petiolata* species-group is recorded from the Palearctic, Indo-Pacific and Australian regions, and the *L. dorsigera* species-group is recorded from the Palearctic and Indo-Pacific regions.

Nearctic and Neotropical regions

***Leucospis affinis* species-group**

DIAGNOSIS. Propodeum with a raised callus or hump on the median area (Fig. 3, 11/2; cf. median carina present or absent in all other species-groups).

REMARKS. Fig. 3 suggests that the *L. hopei* and *L. affinis* species-groups are related to the Old World *L. gigas* and *L. elegans* species-groups by the loss of the median carina on the propodeum (11/1); the raised callus on the propodeum in the *L. affinis* species-group is a further modification.

***Leucospis cayennensis* species-group**

DIAGNOSIS. Mandible with semi-circular emargination (Fig. 3, 2/1; cf. triangular in all other species-groups).

REMARKS. Fig. 3 weakly supports a clade consisting of the *L. cayennensis*, *L. egaia* and *L. speifera* species-groups.

***Leucospis egaia* species-group**

DIAGNOSIS. Body color non-metallic but with iridescent reflections; clypeus without a median tooth; mandible with triangular emargination; occipital carina strong, distinctly extended past eye margin; pronotum with marginal carina.

REMARKS. Fig. 3 weakly supports a clade consisting of the *L. cayennensis*, *L. egaia* and *L. speifera* species-groups. The *L. speifera* and *L. egaia* species-groups, which together comprise over one-half of all New World species (Table 1) are only distinguished by the presence or absence of the marginal carina on the pronotum. All other characters are either the same or overlapping and both species-groups are highly polymorphic for many other character states (Appendix 2). Establishing the monophyly of the *L. speifera* and *L. egaia* species-groups or a revised species-group delineation is a high priority for future research.

***Leucospis hopei* species-group**

DIAGNOSIS. Body color non-metallic, without iridescent reflections; hind tibia extended, adtarsal margin concave, with indistinct outer spur.

Table 1. Geographic distribution of species-groups and species sola and number of species of *Leucospis* Fabricius. Biogeographic regions follow Schuh & Stonedahl (1986) for the Old World tropics; [] indicates a fossil species; total number of species: 114; note: some species are found in >1 biogeographic region.

Taxa	Nearctic	Neotropical	Ethiopian	Palaearctic	Indo-Pacific	Australian	Subtotals
<i>affinis</i> species group	1	4					4
<i>antiqua</i> (species sola)					1		1
<i>aruina</i> species group					3		3
<i>australis</i> species group						5	5
<i>cayennensis</i> species group		9					9
<i>dorsigera</i> species group				7	1		7
<i>egaia</i> species group		9					9
<i>elegans</i> species group			8	2	9		19
<i>fuelleborniana</i> species group			2				2
<i>gigas</i> species group			2	2	2		6
<i>holubi</i> (species sola)			1				1
<i>hopei</i> species group		9					9
<i>micrura</i> species group					6		6
<i>namibica</i> (species sola)			1				1
<i>pediculata</i> species group					5		5
<i>petiolata</i> species group				1	5	2	7
<i>regalis</i> (species sola)					1		1
<i>speifera</i> species group	2	11[1]					11[1]
<i>texana</i> species group	2	2					3
<i>tricolor</i> species group			4				4
Number of species-groups	3	6	6	4	9	2	
Number of species	5	44[1]	18	12	33	7	113[1]

REMARKS. There are no defining apomorphies identified in Fig. 3. The *L. hopei* species-group shares a derived configuration of the hind tibia with the Ethiopian *L. gigas* and *L. elegans* species-groups (the outer tibial spur is indistinct) and may be the New World representative of this lineage.

***Leucospis speifera* species-group**

DIAGNOSIS. Body color non-metallic but with iridescent reflections; clypeus without a median tooth; mandible with triangular emargination; hind tibia apex truncate to slightly extended; pronotum without carinae.

REMARKS. Fig. 3 weakly supports a clade consisting of the *L. cayennensis*, *L. egaia* and *L. speifera* species-groups; see also remarks for the *L. egaia* species-group.

***Leucospis texana* species-group**

DIAGNOSIS. Body color non-metallic, without iridescent reflections; basal tooth on hind femur very small (16/1; cf. long in all other species-groups); outer spur of hind tibia a recurved hook.

REMARKS. The reduced basal tooth and highly modified outer tibial spur is shared only with the Ethiopian *L. tricolor* species-group (Fig. 3). See also remarks for the Ethiopian *L. fuelleborniana* species-group.

Paleartic region

Four species-groups occur in the Mediterranean and West Palearctic regions (sensu Bouček 1974). All are found in other regions of the Old World tropics and only the *L. dorsigera* species-group is maximally speciose in the Palearctic region.

***Leucospis dorsigera* species-group**

DIAGNOSIS. Basal tooth on hind femur at least as large as femoral teeth; marginal and premarginal carinae on pronotum distinct but not strongly recurved (cf. *L. elegans* species-group); propodeum short, not distinctly longer than dorsellum.

REMARKS. *Leucospis japonica* Walker, 1871 is widely distributed in temperate Asia and its range extends as far south as northern India and Taiwan (Bouček 1974). The later is the only record of the *dorsigera* species-group from the Indo-Pacific region.

***Leucospis elegans* species-group**

DIAGNOSIS. Pronotum with discal, marginal, and premarginal carinae distinct and strongly angulate and strongly recurved toward mesoscutum.

REMARKS. This species-group is well represented in the Ethiopian and Indo-Pacific regions (q.v.).

***Leucospis gigas* species-group**

DIAGNOSIS. First and second basal femoral teeth oriented at an angle relative to distal teeth; distal femoral teeth parallel-sided, apices rounded; pronotum without discal carina; T5 short, less than 4 times the length of T4; ovipositor sheaths long, reaching the base of T1.

***Leucospis petiolata* species-group**

DIAGNOSIS. Basal tooth of hind femur distinct but smaller than femoral teeth; pronotum without discal carina; T5 long, at least 4 times the length of T4; propodeum long, about twice length of dorsellum.

Ethiopian region

Four species-groups and 2 species sola are present in sub-saharan Africa; two of the species-groups, *L. fueleborniana* and *tricolor*, are endemic (Table 1). All species are non-metallic in colour without iridescent reflections. The sister genus of *Leucospis*, *Micrapion* (Fig. 3), is restricted to the Ethiopian region.

***Leucospis elegans* species-group**

DIAGNOSIS. Pronotum with discal, marginal, and premarginal carinae distinct and strongly angulate and strongly recurved toward mesoscutum.

REMARKS. This species-group is also well represented in the Indo-Pacific region (q.v.).

***Leucospis fueleborniana* species-group**

DIAGNOSIS. Mesoscutum with cross carina (Fig. 3, 8/2; cf. absent in all other species); femoral teeth arranged in a line; distal femoral teeth triangular, apices pointed; T5 long, at least 4 times the length of T4.

REMARKS. Fig. 3 supports the contention of Bouček (1974) that the *L. petiolata* and *L. fuelleborniana* species-groups are closely related and could be regarded as a single species-group; the later is distinguished by the apomorphic configuration of the mesoscutum. Both species-groups also share a highly modified hind tibia with the outer spur represented as a short pointed nub. Consistent with this hypothesis is the absence of the *L. petiolata* species-group from the Ethiopian region (Table 1). These two species-groups have a sister group relationship with *L. texana* + *L. tricolor* species-groups (Fig. 3) suggesting that the New World *L. texana* species-group has Ethiopian affinities.

***Leucospis gigas* species-group**

DIAGNOSIS. First and second basal femoral teeth oriented at an angle relative to distal teeth; distal femoral teeth parallel-sided, apices rounded; ovipositor sheaths long, reaching the base of T1; stigmal vein bilobed, stigma and uncus distinct (as in Fig. 1); T5 short, less than 4 times the length of T4.

***Leucospis tricolor* species-group**

DIAGNOSIS. Basal tooth on hind femur very small; outer spur of hind tibia a recurved hook.

REMARKS. See discussion of the New World *L. texana* species-group.

***Leucospis holubi* species sola**

REMARKS. This is the only Ethiopian species with the stigmal completely reduced (i.e., stigma and uncus contiguous, as in Fig. 2). This character state is diagnostic for the Indo-Pacific *L. micrura* species-group and interpreted as a convergence (see also remarks under *L. micrura* species-group).

***Leucospis namibica* species sola**

REMARKS. This is the only described species with the posterior margin of the fourth gastral tergite (T4) angulate and produced toward the apex of the ovipositor furrow on T5. This character is diagnostic for *Micrapion* and this similarity was noted by Bouček (1974). Also, *L. namibica* Bouček, 1974 is the only Ethiopian species with a tooth on the hind coxa, which is also found in species of *Micrapion*. Fig. 3 suggests that these similarities are a result of convergence. Undescribed species closely related to *L. namibica* have recently been collected in South Africa and Madagascar (California Academy of Sciences) and this material and recently collected specimens of *Micrapion* will allow a closer study of relationships of *Leucospis namibica* and *Micrapion*.

Australian region

This region comprises Australia, exclusive of the wet tropics of Queensland, including New Zealand, Lord Howe and Norfolk islands (sensu Gressitt 1956). Only seven species and two species-groups are represented, the widely distributed *L. petiolata* species-group and the endemic *L. australis* species-group.

***Leucospis australis* species-group**

DIAGNOSIS. Basal tooth of hind femur at least as long as femoral teeth; dorsellum bidentate.

REMARKS. The *L. australis* species-group is interpreted as the sister group of *L. regalis* species sola (Fig. 3). This sister group relationship is supported by the shape of the hind coxa (12/2; with

dorsal edge elongate and narrowed) and the presence of a tooth on the hind coxa (13/3). The first character is also found in a single species of the *L. petiolata* species-group and the second also characterizes the *affinis* species-group. There are sporadic occurrences of a tooth on the hind coxa in other species-groups (e.g., the New World *L. egaia* and *L. speifera* species-groups, *L. petiolata* species-group).

***Leucospis petiolata* species-group**

DIAGNOSIS. Basal tooth of hind femur distinct but smaller than femoral teeth; dorsellum transverse, apex acarinate and rounded.

REMARKS. See discussion under the Indo-Pacific region and of the Ethiopian *L. fuelleborniana* species-group.

Indo-Pacific region

The Indo-Pacific region (sensu Schuh & Stonedahl 1986 and Gressitt 1956) comprises the tropical zones of the Asiatic and Australian regions (sensu Bouček 1974) and includes New Caledonia. This region has the highest diversity of species-groups (7) and two species sola. We have partitioned Bouček's *L. pediculata* species-group into two groups, the *L. pediculata* species-group (revised composition) and the *L. micrura* species-group. There are no characters uniting these species (Fig. 3) but as will be discussed, both groups are easily distinguished and arguably monophyletic on the basis of morphological characters. This realignment of species will facilitate the description of new species in both species-groups and will allow phylogenetic analyses of species relationships and subsequent historical biogeographic analyses of these clades (Darling in prep.).

***Leucospis dorsigera* species-group**

DIAGNOSIS. Basal tooth on hind femur at least as large as femoral teeth; discal carina absent; marginal and premarginal carinae on pronotum distinct but not strongly recurved (cf. *L. elegans* species-group); propodeum short, not distinctly longer than dorsellum.

REMARKS. *Leucospis japonica* is the only Palearctic species that extends its range south into the Indo-Pacific region. Long series of specimens have been collected in Taiwan (data in Bouček 1974).

***Leucospis gigas* species-group**

DIAGNOSIS. Basal tooth on hind femur distinct but smaller than femoral teeth; first and second basal femoral teeth oriented at an angle relative to distal teeth; distal femoral teeth parallel-sided, apices rounded; discal carina absent.

REMARKS. Two species are recorded for this region: *L. darjilingensis* Mani, 1937 is known only from the holotype (North India) and *L. histrio* Maindron, 1878 is distributed across the region, from India to the Solomon Islands.

***Leucospis elegans* species-group**

DIAGNOSIS. Pronotum with discal, marginal, and premarginal carinae distinct and strongly angulate and strongly recurved toward mesoscutum; hind femur robust, length at most twice maximum width.

REMARKS. The *L. elegans* species-group is equally diverse in both the Ethiopian and Indo-Pacific regions. The consensus tree of the species data matrix recognized two clades for the *L. elegans*

group species. One contained 3 species (Palearctic and Ethiopian) and the other contained all of the Indo-Pacific species, 2 Ethiopian species and *L. holubi* Bouček, 1974. These two groups differ primarily in the structure of the dorsellum. Bouček (1974) noted differences in the shape of the middle teeth of the hind femur in the Ethiopian and Indo-Pacific species (character not used in this study). These characters and the high degree of polymorphism in Appendix 2 question the monophyly of this species-group.

***Leucospis petiolata* species-group**

DIAGNOSIS. Body color non-metallic without iridescent reflections; apex of hind tibia extended into a finger-like projection, the outer tibial spur a short pointed nub; femoral teeth arranged in a line; distal femoral teeth triangular, apices pointed.

REMARKS. Although speciose and widely distributed (Japan, throughout the Indo-Pacific region, Australia to the Solomon islands) this species-group shows low levels of polymorphism for the characters coded in Appendix 2. However, the cladistic analysis provides no support for the monophyly of this species group. See also discussion of the Ethiopian *L. fueleborniana* species-group.

***Leucospis pediculata* species-group**

(Fig. 1)

This and the following species-group are segregates of the *L. pediculata*-group (sensu Bouček 1974). Bouček provided a list of characters for his more inclusive species-group and most of these were included in the interactive identification key and also in the cladistic analysis. There is no support for the monophyly of a combined group (Fig. 3). One possible unifying character, used by Bouček in his identification key, is the dark apical spot on the apex of the forewing. All species have a darker apical spot on the forewing except *L. giraulti* Bouček, 1974 (Queensland, Australia). However, a dark apical spot is also found in some species of *Micrapion*.

DIAGNOSIS. Hind femur with comb of 25 or more very small teeth (Fig. 1); stigmal vein bilobed, stigma and uncus distinct (Fig. 1).

REMARKS. Bouček (1974) used the comb-like teeth on the hind femur to group the described species in his identification key (p. 159). This configuration of the femur is unique in *Leucospis* and interpreted as a synapomorphy in Fig. 3 (15/2). We restrict membership in this species group to *Leucospis pediculata* Guérin-Méneville, 1844; *L. calligastri* (Ferrière 1938); *L. giraulti* Bouček, 1974; *L. pyriformis* (Weld, 1922), and *L. williamsi* Bouček, 1974. See Noyes (2004) for species synonymies. There are also two undescribed species (Darling, in prep.), from Indonesia (Sulawesi, Fig. 1) and the Philippines.

***Leucospis micrura* species-group**

(Fig. 2)

We newly establish this species-group as the second segregate of the *L. pediculata*-group (sensu Bouček 1974).

DIAGNOSIS. Hind femur with less than 25 larger, triangular teeth (Fig. 2); stigmal vein with stigma and uncus contiguous (Fig. 2);

REMARKS. We assign to the *L. micrura* species-group *Leucospis micrura* Schletterer, 1890; *L. bakeri* Crawford, 1915; *L. globigera* Bouček, 1974; *L. lankana* Bouček et Narendran, 1981; *L. maculata* Weld, 1922; and *L. nambui* Habu, 1977. See Noyes (2004) for species synonymies. There are also seven undescribed species (Darling, in prep.) from Thailand (Fig. 2), Malaysia, and

Indonesia. The only other species in the genus with the apomorphic configuration of the stigmal vein is the Ethiopian species *L. holubi*. A similar configuration of the stigmal vein was illustrated in Bouček (1974) for *Micrapion richardsi* Bouček, 1974 (his fig. 264). All other species of *Micrapion* examined have the stigma and uncus separate suggesting that a contiguous stigma and uncus is apomorphic in *Leucospis*.

***Leucospis aruina* species-group and *L. antiqua* species sola**

DIAGNOSIS. Body color non-metallic but with iridescent reflections, prominent on vertex; hind coxa very elongate, dorsal edge flat or convex with broad dorsal side.

REMARKS. Bouček (1974) recognized both the distinctness of the 3 included species of his *L. aruina* species-group and also proposed the sister group relationship with *L. antiqua* Walker, 1860 suggested in Fig. 3. The only outstanding question is whether all these should be treated as a single species-group. The absence of the discal carina in the *L. aruina* group species was noted and emphasized by Bouček but there are only a total of 5 morphological differences in the characters listed in Appendix 2. These concern the sculpture of the dorsellum, the length of a hind tibial carina, the occipital carina and the length of the propodeum. These are all characters that vary within at least some species-groups. *Leucospis antiqua* is the only species of *Leucospis* with a very narrow hind femur, the length about 3 times the width. It is also the only species outside the *L. elegans* species-group to have the pronotal carinae distinct, strongly angulate and strongly recurved toward mesoscutum. This species is restricted to New Caledonia and surrounding islands, a region famous for harbouring phylogenetically-distinct and basal lineages (Chazeau 1993, Lowry 1998). Bouček further suggested that *L. antiqua* and *L. aruina* group species are the most primitive in the genus *Leucospis* but did not elaborate further. The extremely elongate coxa is shared with the basal genus of the Leucospidae, *Polistomorpha* but all other shared similarities are absences of characters that define the other species-groups. Fig. 3 does not reject a sister group relationship of the *L. aruina* species-group + *L. antiqua* with the rest of the genus.

***Leucospis regalis* species sola**

This is the only species of *Leucospis* that is completely metallic in color, with vibrant iridescent reflections. An affinity with the *L. australis* species-group is suggested in Fig. 3. See discussion of the *L. australis* species-group.

CONCLUSIONS

There are two general conclusions from this re-examination of Bouček's (1974) treatment of *Leucospis*. Firstly, the revision has stood the test of time and 30 years later remains the starting point for the study of the taxonomy of these wasps. Secondly, less than one-half (7 of 16) of the species-groups proposed by Bouček are demonstrably monophyletic based on the currently available suite of morphological characters. This is not to say that the species-groups are not of utilitarian value but at present it would be inappropriate to focus interpretive studies of host associations or biogeography on these unsupported species-groups. This is one reason for partitioning the *L. pediculata* species-group (sensu Bouček 1974) into putatively monophyletic species-groups.

There are other ways to manipulate the data in Appendix 2 to possibly improve the resolution of the cladogram (e.g., increase the consistency index, resolve polytomies). For example, Wiens (1998) has shown with simulation studies that majority coding (removing polymorphisms by using the most common state) improves the accuracy of cladograms. Simmons (2001) suggests aban-

doning the use of ambiguity coding and using exemplars providing that there is an adequate breath of taxon and character sampling but notes that data sets can become too large to be effectively analyzed. This is the approach we used with the species matrix (70 taxa) and as predicted the analysis became computationally challenging. Another possible source of error is the use of *Polistomorpha* as the outgroup taxon. This genus is highly apomorphic in a number of characters (e.g., mouthparts) and it might be instructive to use a variety of basal Chalcididae (Wijesekara 1997) to determine character polarity in *Leucospis*.

This phylogenetic analysis serves to highlight Bouček's appreciation of the high degree of variability in gross morphological characters in the genus (p. 30-34, 101, 155 and in the keys to species). Many of the characters are derived from the hind legs and there are correlated suites of characters on the femur and tibia, and perhaps also on the coxa. It is almost certain that there is a functional suite of characters involved with the hind legs. Similar leg modifications are also found in the Chalcididae (Wijesekara 1997), Torymidae (Grissell 1995), and Pteromalidae – Cleoninae (Gibson 2003) which supports the hypothesis of convergent modifications. This analysis has shown that these characters alone will not be able to resolve the phylogenetic relationships of the species of *Leucospis*. As for most families of Chalcidoidea, we need to develop novel and detailed character systems based on comparative morphology rather than simply throwing up our hands and grasping at DNA straws.

DISCUSSION

There is much talk today about how to rejuvenate taxonomy, a discipline both steeped in formalized rules and of unparalleled relevance for the preservation of biodiversity in the twenty-first century (e.g., Godfray & Knapp 2004). One radical approach is to fully embrace twenty-first century information science and the Internet to move forward expeditiously to catalogue the diversity of life rather than conducting business as usual. Godfray (2002) has suggested that the taxonomy of particular groups be based on a "first web revision" and that after adoption by the scientific community all future work on the group would start with that revision. The taxonomy of the group would, in Godfray's words, "at a stroke be liberated from nineteenth-century descriptions and potentially undiscovered synonyms". For Leucospidae, Bouček (1974) would only need to be updated and converted electronically to be that "first web revision". Perhaps we should even take this one step further and suggest that this "first web revision" be the new starting point for the nomenclature of the Leucospidae. If the 60 synonymies and 91 lectotypes established in Bouček (1974) were accepted by the chalcidological community the 114 valid names (Noyes 2004) would become the only available names for *Leucospis*. The "first web revision" would effectively become the "New Linnaeus 1758" for this family. The International Code of Zoological Nomenclature (ICZN 1999) has opened the door for such initiatives (Scoble 2004). Article 79 states that an international body of zoologists may propose that the Commission adopt for a major taxonomic group a Part of the List of Available Names in Zoology. But why restrict this list to available names? If future taxonomists working in the group only had to consider the 114 valid names of *Leucospis*, all of which would be described and illustrated in the "first web revision", the descriptions of new species could be expedited. This would ultimately lead to not only a better understanding of the alpha-diversity of *Leucospis* but also to a more robust phylogeny. It would then be possible to answer questions about the evolution of host associations, mimicry, and speciation in *Leucospis*. We hasten to add that Article 79 provides checks and balances and

that the establishment of a new starting point for the taxonomy of any group should not be taken lightly and without careful review by the scientific community.

Bouček's (1974) world revision of the family Leucospidae stands as a model in the Chalcidoidea. This taxonomy has stood the test of time and it has and will remain the starting point for the study of these wasps into the future. Regardless of whether or not the taxonomic decisions become fixed in the future by a decision of the International Commission on Zoological Nomenclature, this publication or its critical components, the descriptions and illustrations, should be made available electronically on the web. It would be a fitting tribute to the outstanding career of Zdeněk Bouček to have his revision of the Leucospidae as the first web-based revision of a family of Chalcidoidea.

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This paper is dedicated to Zdeněk Bouček on the occasion of his 80th birthday. He has been an inspiration to the senior author for the past twenty five years and it has been both a pleasure and a challenge to muddle along in his footsteps. Assistance with the numerical cladistic analyses was provided by Andy Bennett and Mike Spironello. This research was supported by operating grants from the Natural Sciences and Engineering Research Council of Canada to D. C. Darling and L. Packer.

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Appendix 1. Character descriptions. All characters are unordered. For more complete descriptions and illustrations of the various characters and states see Cardinal & Darling 2005).

1. Clypeus: without median tooth = 1; with median tooth = 2.
2. Mandibular emargination: semicircular = 1; triangular = 2.
3. Occipital carina: indistinct = 1; distinct = 2; strong = 3.
4. Discal carina: absent = 1; present = 2.
5. Premarginal carina: absent = 1; present = 2.
6. Marginal carina: absent = 1; present = 2.
7. Pronotal carinae (if present): transverse = 1; recurved, subangulately raised = 2.
8. Mesoscutum, cross carina: absent = 1; present = 2.
9. Dorsellum, apex: acarinate = 1; carinate = 2.
10. Dorsellum, shape: transverse, apex rounded = 1; produced, apex rounded or emarginate = 2; produced, apex strongly bidentate = 3.
11. Propodeum, median area: carina absent = 1; with a distinct raised callus = 2; carina present = 3.
12. Hind coxa, shape: very elongate, with broad dorsal side = 1; elongate, with narrow dorsal side = 2; quadrate, with narrow dorsal side = 3.
13. Hind coxa, dorso-posterior edge: smooth = 1; carinate or with serrate carina = 2; with distinct tooth = 3.
14. Hind femur, shape: slender = 1; robust = 2.
15. Hind femur, teeth: irregular, less than 25 = 1; comb-like, more than 24 = 2.
16. Hind femur, basal tooth: absent or extremely small = 1; smaller than femoral teeth = 2; at least as large as femoral teeth = 3.
17. Hind femur, orientation of basal femoral teeth: second and often the first at an angle relative to the distal teeth = 1; all teeth linear = 2.
18. Hind femur, shape of distal femoral teeth: triangular = 1; parallel-sided = 2.
19. Hind tibia, apex: truncate to slightly extended = 1; extended, adtarsal margin concave, with distinct outer spur = 2; extended, adtarsal margin concave, with indistinct outer spur = 3; extended, adtarsal margin straight or slightly convex or concave, outer spur a pointed nub = 4; extended, adtarsal margin straight or slightly convex or concave, outer spur a recurved hook = 5.
20. Hind tibia, length of outer carina: short, less than 1/2 length of tibia = 1; intermediate, 1/2 to 3/4 length of tibia = 2; long, greater than 3/4 length of tibia = 3.
21. Hind tibia, shape of outer carina: straight = 1; wavy = 2.
22. T1, shape (female): transverse = 1; quadrate = 2; elongate = 3.
23. T5, length (female): short = 1; long = 2.
24. T5, shape in lateral view (female): flat = 1; angulate, T6 and epipygium visible in dorsal view = 2; expanded, T6 and epipygium not visible in dorsal view = 3.
25. T4, posterior margin (female): rounded = 1; angulate = 2.
26. Ovipositor furrow, shape (female): divergent = 1; parallel-sided = 2.
27. Ovipositor furrow, length (female): short or absent = 1; intermediate = 2; long = 3.
28. Ovipositor sheaths, length (female): short = 1; intermediate = 2; long = 3.
29. Propodeum, length: short = 1; intermediate = 2; long = 3.

30. Body coloration: completely non-metallic = 1; non-metallic but with iridescent reflections on some structures = 2; completely metallic = 3.

31. Forewing: without infusate apical spot = 1; with infusate apical spot = 2.

32. Stigmal vein, shape: stigma and uncus contiguous = 1; bilobed, stigma and uncus distinct = 2.

Appendix 2. Character matrix of 32 morphological characters for 16 species-groups (gp) and 4 species sola (ss) of *Leucospis* Fabricius, including two outgroup taxa (see Appendix 1 for character definitions). #, states 1, 2, and 3 present

Taxa	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	
<i>Polistomorpha</i>	1	2	3	1	1	1	?	1	1	1	3	1	3	1	1	3	2	1	1	1	1	2	2	1	2	?	?	?	1	3	1	1	1
<i>Micrapion</i>	1	2	1	1	1	2	1	1	1	1	3	3	23	2	1	3	2	1	1	2	1	3	2	23	2	2	2	2	3	1	2	2	
<i>affinis</i> gp	2	2	12	1	2	2	1	1	1	1	2	3	3	2	1	3	2	1	1	2	1	2	1	1	1	12	3	3	2	12	1	2	
<i>antiqua</i> ss	2	2	1	2	2	2	2	1	2	2	3	1	1	1	1	3	2	1	1	1	1	2	2	2	1	2	2	2	3	2	1	2	
<i>aruina</i> gp	2	2	2	1	2	2	1	1	2	2	3	1	1	2	1	3	2	1	1	2	1	2	2	2	1	2	2	2	23	2	1	2	
<i>australis</i> gp	2	2	2	12	12	12	1	1	2	3	3	2	3	2	1	3	2	1	1	2	1	2	1	1	1	1	2	3	3	2	2	1	2
<i>cayennensis</i> gp	2	1	23	1	1	1	1	1	12	12	3	3	2	2	1	3	2	1	1	2	1	1	1	12	1	2	23	23	23	2	1	2	
<i>dorsigera</i> gp	2	2	2	12	2	2	1	1	2	23	3	3	2	2	1	3	2	1	13	2	1	23	1	1	1	12	23	23	12	1	1	2	
<i>egaia</i> gp	1	2	3	1	1	2	1	1	2	2	3	3	23	2	1	3	2	1	13	23	1	23	2	1	1	1	3	3	#	2	1	2	
<i>elegans</i> gp	2	2	2	2	2	2	2	1	12	12	13	3	2	2	1	23	2	1	3	23	1	2	12	12	1	2	23	23	23	1	1	2	
<i>fuelleborniana</i> gp	2	2	2	1	2	2	1	2	1	1	3	3	2	2	1	2	2	1	4	3	2	2	2	2	1	2	2	2	3	1	1	2	
<i>gigas</i> gp	2	2	2	1	2	2	1	1	12	#	13	3	2	2	1	2	1	2	34	3	2	2	2	1	1	12	3	3	2	1	1	2	
<i>holubi</i> ss	2	2	2	1	2	2	2	1	1	1	1	3	2	2	1	3	2	1	2	3	2	1	3	2	1	1	3	3	2	1	1	1	
<i>hopei</i> gp	12	2	2	1	12	2	1	1	12	12	13	3	2	2	1	3	2	1	3	2	1	12	1	1	1	2	3	3	2	1	1	2	
<i>micrura</i> gp	2	2	2	12	2	2	1	1	2	2	3	3	12	2	1	3	2	1	1	2	1	2	2	23	1	2	12	12	23	1	2	1	
<i>namibica</i> ss	2	2	2	1	2	2	1	1	2	2	3	3	23	2	1	3	2	1	1	?	?	?	3	1	2	2	2	2	3	1	1	2	
<i>pediculata</i> gp	2	2	12	12	12	2	1	1	12	#	3	3	2	2	2	3	2	2	1	2	1	2	2	23	1	2	12	12	3	1	12	2	
<i>petiolata</i> gp	2	2	2	1	2	2	1	1	1	1	3	23	23	2	1	2	2	1	4	3	1	2	2	12	1	2	2	2	3	1	1	2	
<i>regalis</i> ss	2	2	2	1	2	2	1	1	2	2	3	2	3	2	1	2	2	1	4	?	?	?	2	1	1	1	2	3	3	2	3	1	2
<i>speifera</i> gp	1	2	23	1	1	1	?	1	2	2	3	3	23	2	1	3	2	1	1	23	1	23	12	1	1	12	23	23	23	2	1	2	
<i>texana</i> gp ¹	1	2	2	1	1	1	?	1	1	1	3	3	1	2	1	1	1	2	5	3	2	1	2	3	1	2	1	1	23	1	1	2	
<i>tricolor</i> gp	2	2	2	1	2	2	1	1	1	3	3	3	1	2	1	1	1	2	5	3	2	1	12	2	1	2	2	2	23	1	1	2	

A revision of the West-Palearctic *Podagrion* (Hymenoptera: Torymidae), with the description of *Podagrion bouceki* sp. nov.

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Abstract. The West Palearctic species of *Podagrion* Spinola, 1811 are revised and keyed out. *Podagrion bouceki* sp. nov. is described. *Podagrion pachymerum* var. *gibba* Bernard, 1938 is treated as a valid species. *Podagrion pachymerum* var. *rufiventre* Giraud, 1863 and *Cleptimorpha binotata* Walker, 1872 are synonymized with *Podagrion pachymerum* (Walker, 1833), *Podagrion meridionale* Masi, 1935 and *Podagrion enei* Bakkendorf, 1960 with *Podagrion klugianum* (Westwood, 1847). *Priomerus insidiosus* Coquerel, 1856, *Podagrion armigerum* Masi, 1940, *Podagrion tarachodesi* Risbec, 1951 are treated as subspecies of *P. klugianum* (Westwood, 1847). Neotypes are selected for *Podagrion splendens* Spinola, 1811, the type species of the genus, for *Priomerus insidiosus* Coquerel, 1856 and *Cleptimorpha binotata* Walker, 1872. Lectotypes are designated for *Podagrion pachymerum* var. *rufiventre* Giraud, 1863, *P. meridionale* Masi, 1935, *P. armigerum* Masi, 1940, *P. pachymerum* var. *gibba* Bernard, 1938 and *P. tarachodesi* Risbec, 1951.

Taxonomy, new species, lectotype designation, neotype, key, distribution, Hymenoptera, Chalcidoidea, Torymidae, *Podagrion*, mantid hosts, Europe, Mediterranean Basin, Palaearctic region

INTRODUCTION

Species of *Podagrion* Spinola, 1811 are well known parasitoids of mantids egg-cases (Chopard 1922, Parker 1926, Picard 1933, 1936, Sellenschlo 1984, Grissell 1995). Available keys for the west palearctic species (Nikol'skaya 1952, Zerova & Seryogina 1999) deal only with two species as does Bou ek (1976). However the examination of European material and from the Southern part of the Mediterranean Basin revealed that the biodiversity of *Podagrion* is greater. The general aim of this study is to revise the euro-mediterranean species of *Podagrion* and provide morphological features to distinguish the species. Unfortunately most of the species are very similar, if not sibling. I therefore previously investigated the possibility of using quantitative characters to separate the putative species (Delvare 2002). Because I did not initially know the range of intraspecific and allometric variation, especially that correlated with environmental factors, I also screened the influence of the mantid host on the morphology of the parasitoids in order to better select discriminant characters for species segregation. The possibility that the putative species found in southern France to interbreed was also studied through crossing tests and detailed observations of their courtship behaviour (Delvare 2002). This latter study showed that *P. pachymerum* var. *gibba* should be recognized a valid species species based on its morphology and apparent reproductive isolation from *P. pachymerum*. The species treated in Delvare (2002) as *Podagrion* sp. is a common and widely distributed undescribed species; a clear barrier exists in its sexual behaviour relative to *P. pachymerum* and *P. splendens*. The present revision of regional species takes into account the results of Delvare (2002) as well as the examination of type material and recent samples

collected in Europe and the Mediterranean Basin to revise the regional species. This study is a part of a more extensive project concerning the World Podagrionini which includes a phylogenetic reassessment of the tribe, a revision of the afrotropical species, and morphometric and biological studies.

MATERIAL AND METHODS

Material

All available types were examined and neotypes were selected when it was confirmed that the typical material was lost; this selection agrees with the present rules of the code of nomenclature (ICZN 1999). Several hundreds of specimens were examined during this revision with sampling more extensive in the western mediterranean basin than in the eastern part of the region. A significant proportion of these parasitoids were reared from known hosts. Each culture strain started with one female and successive rearing on different hosts enabled an appreciation of the range of morphological variation, including structural characters (coloration) and quantitative characters (size and form). It was further possible, from careful examination of adults collected in the field to infer the identity of the hosts from which they emerged.

Equipment

Scanning electron micrograph were taken with a JEOL JSM-6300 F scanning enlectron microscope.

Special terms

The sulcus separating the axilla from the scutellum is called the **axillar groove** in preference to scuto-scutello suture. The **adpetiolar area** of the propodeum is the median region anterior to the petiolar foramen; it is delimited anteriorly by oblique carinae that together form an inverted V or Y; a **spiracular groove** is visible laterally behind the spiracle.

Use of the keys

When examining *Podagrion* specimens attention must be paid to the nature and orientation of the light in order to properly appraise sculpture. Preferably, a fluorescent light should be used and the specimens examined in a tangential view, from the posterior or latero-posterior end of the body; this is especially true for examination of the notauli and frenal area. Only hereromorph males (see below for their definition) should be used for the identification of species based on this sex. Homeomorph males are often very similar and they are almost impossible to determine to species.

Abbreviations

F1 – first funicular segment; F2 second funicular segment, etc;
 OD – ocellar diameter, i. e. the diameter of a lateral ocellus;
 OOL – ocellar-ocular distance i. e. the distance between a lateral ocellus and the closest eye;
 POL – postocellar distance i. e. the distance between the lateral ocelli.

Acronyms and institutions

CNCI – Canadian National Collection of Insects, Ottawa, Ontario, Canada;
 GD – Gérard Delvare personal collection, Montpellier, France;
 JYR – Jean-Yves Rasplus personal collection, Montferrier-sur-Lez, France;
 MHNG – Muséum d'histoire naturelle, Genève, Switzerland;
 MNHN – Muséum national d'Histoire naturelle, Paris, France;
 MNM – Museo Nacional de Ciencias Naturales, Madrid, Spain;
 MSNG – Museo Civico di Storia Naturale „G. Doria“, Genoa, Italy;
 NHM – Natural History Museum, London, United Kingdom;
 OUM – Oxford University Museum, Oxford, United Kingdom;
 ZMHB – Zoologisches Museum, Humboldt Universität, Berlin, Germany;
 ZMUA – Zoologisch Museum, Universiteit van Amsterdam, The Netherlands;
 ZMUC – Zoologisk Museum, Universitets Copenhagen, Denmark.

Morphology of the males

The special morphology and polymorphism of *Podagrion* males has already been established by several authors (Chopard 1922, Picard 1936). For the same species several types of males are observed. Some have stronger teeth on their hind femur and a modified hind tibia, relative to the females; they all bear enlarged basitarsi on all legs, the following tarsal segments being very short (Figs 37–41); the ornamentation of the propodeum is also different. Other males are mostly similar to females for these characters. The first type of males are here called

“heteromorph males” whereas the latter are called “homeomorph males”. The culture of isogenotypic strains successively on different hosts revealed that these phenotypes are not inherited but depends only upon the environment, especially the size of the host. Heteromorph males develop upon large or usual hosts for a given *Podagrion* species. Homeomorph males are encountered when reared under unfavourable conditions (e. g., hosts of small size or when competing with another parasitoid). Intermediates between the two morphotypes also often occur.

Biology of *Podagrion*

Grissell (1995) stated that Podagrionini are potential basing his assumption on a sentence in Clausen (1940), mentioned Podagrionini. However Clausen never reared podagrionines and his statement was erroneous because Parker (1926: 360), who studied the pre-imaginal development of *Podagrion pachymerum*, determined that this species was a solitary external parasitoid. My own observations confirm this. When an egg-case is completely parasitized, which often occurs for *Empusa* species (Mantodea : Empusidae), there are as many emerging adult parasitoids as there are egg-cells. Moreover, because the size of the emerging adults depends on the size of the host, it is evident that individuals are solitary parasitoids. Again in the case of *Empusa* egg-cases, it is also physically impossible for the *Podagrion* larvae to move from one egg-cell to another because of the very hard walls that separate them.

TAXONOMY

Key to the West Palearctic species of *Podagrion* (females)

- 1 Antennal flagellum relatively long, F1 1.6–1.95 times as long as wide. Pedicel plus flagellum 1.55–1.65 times as long as width of head (Fig. 11). Propodeum with carinae forming an inverted Y, straight (at least on anterior half) and forming together an angle of 70–75° (Fig. 31). Frenal area smooth, well delimited from anterior part of scutellum through abrupt change in sculpture (Fig. 31). Cubital vein setose along the basal cell, bearing 11–20 hairs (Fig. 16). *P. pachymerum* (Walker)
- 1' Antennal flagellum shorter, F1 1.3–1.5 times as long as wide. Pedicel plus flagellum 1.35–1.5 times as long as width of head (Figs 13, 15). Propodeum different, the carinae either forming a more obtuse angle (Figs 28, 32) or curving outwards from base (Figs 22, 26, 30). 2
- 2(1') Cubital vein of fore wing bare or with very sparse hairs (0–3) along basal cell. Frenal area dull, with fine but distinct reticulation (Figs 21–23). Notauli incomplete, not reaching transscutal line (Figs 21, 22). 3
- 2' Cubital vein of the forewing with at least 4–7 hairs along basal cell. Frenal area smooth or very faintly alutaceous medially, distinctly differentiated from anterior part of scutellum, (Figs 26, 30, 32). Notauli complete, reaching transscutal line (Fig. 24). 5
- 3(2) Ovipositor sheaths longer, 1.5–2 times as long as body. Propodeal carinae as an inverted Y, originated from a short median carina, forming a fairly acute angle at base and curving slightly outwards posteriorly (Fig. 27). Axillar grooves narrow throughout. Scutellum uniformly convex. *P. klugianum* (Westwood)
- 3' Ovipositor sheaths shorter, 1–1.4 times as long as body. Propodeal carinae different; either as an inverted V, forming a very acute angle at base and distinctly curving outwards posteriorly (Fig. 22) (in *P. splendens*) or if an inverted Y, then forming together a right angle and straight (in *P. minus*) (Fig. 45). Axillar grooves often broad anteriorly; scutellum not so convex in center. 4
- 4(3') Hind femur dark, showing some metallic reflections and with 7–8 teeth (rarely 6); OOL shorter to very slightly longer than OD ($\times 0.7$ –1.1) (Fig. 10). Propodeal carinae distinctly curving outwards posteriorly; propodeum rugulose-reticulate (Fig. 22); spiracle as long as distance to hind margin of metanotum. Axillar grooves broad anteriorly. *P. splendens* Spinola
- 4' Hind femur reddish and with 5–6 teeth (rarely 7)(Fig. 46). OOL distinctly greater than OD ($\times 1.3$) (Fig. 9). Propodeum entirely reticulate (Figs 23, 45); propodeal carinae straight; spiracle small, shorter than distance to hind margin of metanotum. Axillar grooves narrow anteriorly. *P. minus* Strand
- 5(2') Frenal area somewhat distinct but dull at low magnification ($\times 25$), finely but distinctly reticulate medially at high magnification. Propodeal carinae mostly straight, delimiting an angle of about 70°. Propodeal spiracle very large, its aperture much more longer than distance to hind margin of metanotum; spiracular groove very deep. *P. sp. indet. A*
- 5' Frenal area mostly smooth at low magnification, at most very faintly reticulate medially (Figs 20, 30, 32). Propodeal carinae different, either curving outwards from their junction (Fig. 26) or nearly delimiting a right angle (Fig. 32); propodeal spiracle smaller, its aperture at most slightly longer than distance to hind margin of metanotum; spiracular groove less deep. 6

- 6(5') Carinae forming together, at mid length of propodeum, an obtuse angle (90–110°) and mostly straight (Fig. 32). Cubital vein of the forewing with 5–10 hairs along basal cell (Fig. 17). Frenal area completely smooth (Fig. 32). OOL greater than OD ($\times 1.2$ – 1.4) (Fig. 6). Fronto-vertex without area of delicate sculpture. *P. gibbum* Bernard
- 6' Carinae forming together, at mid length of propodeum, an acute angle (70–85°) and curving outwards (Fig. 30). Cubital vein of forewing with 10–15 hairs along basal cell (Fig. 18). Frenal area very faintly reticulate medially (Fig. 26). OOL most often slightly shorter than OD ($\times 0.85$ – 1.1) (Fig. 5). Fronto-vertex with a lateral area of delicate reticulation which is more brightly colored in front of lateral ocelli, along eyes (Fig. 5). *P. bouceki* sp. nov.

Key to the West Palearctic species of *Podagrion* (males — heteromorph forms)

- 1 Antennal flagellum relatively long, with F1 2–2.4 times as long as wide (Fig. 12). Pedicel plus flagellum 1.7–1.8 times as long as width of head. Cubital vein of fore wing with 12–15 hairs along basal cell. Notauli complete. Propodeal carinae mostly straight (Fig. 36). Frenal area distinct, with fine reticulation. Penultimate tooth of the hind femur partly fused with terminal one, or narrowly separated from it (Fig. 41). *P. pachymerum* (Walker)
- 1' Antennal flagellum shorter, with F1 1.45–2 times as long as wide (Fig. 14). Pedicel plus flagellum 1.45–1.65 times as long as width of head. Other characters partly disagreeing: either the last two teeth of the hind femur are quite separated, or the frenal indistinct. 2
- 2(1') Propodeal carinae forming an obtuse angle (90–110°) (Fig. 34). Frenal area set off from anterior part of scutellum through an evident change in sculpture, smooth or very finely reticulate. Notauli complete and evident throughout. Last two teeth of the hind femur separated (Fig. 38). 3
- 2' Propodeal carinae forming an acute angle (25–60°) at base and curving outwards (Fig. 33). Frenal area less distinct. Notauli incomplete or hardly visible posteriorly. Hind femur with last two teeth sometimes partly fused (Fig. 37). ... 4
- 3(2) Cubital vein of forewing most often with some (2–7) hairs along the basal cell. OOL larger than OD ($\times 1.1$ – 1.4). Disc of mesonotum and scutellum flat. *P. gibbum* Bernard
- 3' Cubital vein of forewing completely bare along basal cell. OOL shorter than OD ($\times 0.75$). When observed laterally dorsal surface of scutellum distinctly convex and mid lobe of mesoscutum slightly so (Fig. 42). *P. lybicum* Masi
- 4(2') Propodeum with carinae forming an inverted Y, the adpetiolar area rugose, contrasting with reticulate sublateral parts; adpetiolar costulae present and strong, delimiting with the carinae a median subpentagonal area; propodeum strongly sloping laterally; spiracle elongate; spiracular groove deep (Fig. 35). Cubital vein of forewing bare or nearly so (0–2 hairs). Scutellum regularly and evidently convex. Frenal area completely indistinct. Notauli incomplete. *P. klugianum* (Westwood)
- 4' Propodeum different, adpetiolar area less visible and with less contrasting sculpture relative to rest of surface; adpetiolar costulae sometimes missing. Either cubital vein of forewing with some hairs, or notauli are visible or frenal area fairly distinct. 5
- 5(4') Hind femur with penultimate tooth partly fused with the terminal one (Fig. 37). Propodeum with adpetiolar costulae fine but present (Fig. 33); propodeal spiracle relatively elongate. Notauli more or less distinct posteriorly. Frenal area somewhat distinct, with finer reticulation. Cubital vein of forewing at least with some hairs. *P. bouceki* sp. nov.
- 5' Hind femur with penultimate tooth quite separated from the terminal one (Fig. 40). Propodeum with adpetiolar costulae absent or indistinct; propodeal spiracle shorter, oval. Notauli indistinct posteriorly. Scutellum generally less convex, nearly flat on its disc. Frenal area hardly distinct. Cubital vein of forewing sometimes completely bare. 6
- 6(5') Hind femur generally dark, most often black and with 4 strong teeth (Fig. 40). Propodeum rugulose-reticulate and with curving outwards carinae. *P. splendens* Spinola
- 6' Hind femur reddish, with 5 shorter teeth (Fig. 39). Propodeum reticulate, and with carinae straight. *P. minus* Strand

REVIEW OF THE SPECIES

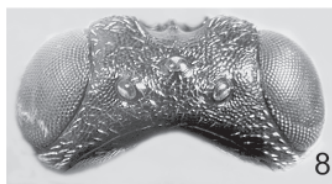
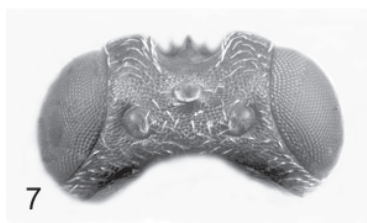
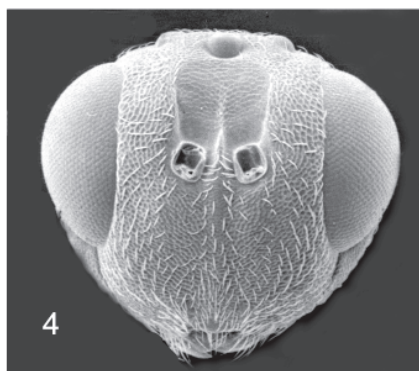
Podagrion bouceki sp. nov. (Figs 2, 5, 15, 18, 20, 26, 30, 33, 37)

TYPE MATERIAL. **Holotype** ♀: SPAIN: Huesca, Casteljon de Monegros, 41°37'10.87"N 00° 12' 28.76" W, 14 VI 2003, ex *Empusa* sp. (A. Foucart) (in NHM). Paratypes. Same references, 19 ♀♀ 2 ♂♂ ; (in NHM, MNHN, GD). PORTUGAL: Coimbra, 1 ♀, Gois, 17 V 1991 (M.J. Gijswijt) (in ZMUA). SPAIN: Cáceres, 1 ♀, 16 km S Placencia, 10 VI 1994 (M.J. Gijswijt) (in ZMUA); Cadiz, 1 ♀, Jimena de la Frontera, 11 VI 1986 (M.J. Gijswijt) (in ZMUA); 1 ♂, Ubrique, 14 V 1995 (M.J. Gijswijt) (in ZMUA); Málaga, 1 ♀, Casares, 8/10 VI 1986 (M.J. Gijswijt) (in ZMUA); 1 ♀, Manilva, 12 km SW Estepona, 18 V 1990 (M.J. Gijswijt) (in ZMUA); 1 ♀, Arcos de la Frontera, 12/13 VI 1986 (M.J. Gijswijt) ; Almería, 3 ♀♀, Mojacar, 13 IV 1990 & 26 IV 1994 (M.J. Gijswijt) (in ZMUA); 1 ♀, Cuevas del



Fig. 1. *Podagrion bouceki* sp. nov., a female ovipositing in an egg-case of *Empusa pennata* (Thunberg).

Almanzora, 14 V 1992 (M.J. Gijswijt) (in ZMUA); 2 ♀♀, Villaricos, 22 IV/1 V 1994 (M.J. Gijswijt) (in ZMUA); 1 ♀, Canton, 8 IV 1994 (M.J. Gijswijt) (in ZMUA); 1 ♀, 15 km N Tabernas, 30 IV 1995 (M.J. Gijswijt) (in ZMUA); 1 ♀, Mojacar, 14 VI 1994 (G. Delvare) (in GD); 1 ♀, San Isidro, 5 VI 1994 (G. Delvare) (in GD); 3 ♀♀, Sierra de Gata, La Isleta 16 VI 1994 (G. Delvare) (in GD); Murcia, 2 ♀♀, Sorbas, 5 VI 1994 (G. Delvare) (in GD); 1 ♀, Southern slope of Sierra Nevada, Juviles, 7 VI 1994 (G. Delvare) (in GD); Madrid, 1 ♀, Monzanares, 3 VII 1986 (M.J. Gijswijt) (in ZMUA); Valencia, 1 ♀, Saler, 18 V 1989 (J.-Y. Rasplus) (in JYR); 1 ♀, El Saler, 22 VI 1992 (T. Oltra) (in JYR); Alicante, 1 ♀, Rebate, 13 X 1990 (J.-Y. Rasplus) (in JYR); 1 ♀, Guardamar a. Seu, 13 X 1990 (J.-Y. Rasplus) (in JYR); Castellón, 1 ♀, Alfondeguilla, 14 V 1989 (J.-Y. Rasplus) (in JYR); 1 ♀, Sierra Espadan, 40 km N Valencia, 20 V 1987 (M.J. Gijswijt) (in ZMUA); Cuenca, 1 ♀, Metilla del P. along CU 504, 24/29 V 1987 (M.J. Gijswijt) (in ZMUA). FRANCE: Pyrénées Orientales, 1 ♀, Néfiach, 18 IV 1990 (J.-Y. Rasplus) (in JYR); Hérault: 1 ♀, Marseillan-Plage, 15 VIII 1964 (in JYR); 1 ♀, Vic-la-Gardiole, Les Aresquiers, 17 VI 1990 (G. Delvare) (in GD); 2 ♀♀, Saint-Guilhem-le-Désert, les Lavagnes, 31 V 1990 (G. Delvare) (in GD); 1 ♀, Pégairolles-de-Bueges, 15 IX 1985 (G. Delvare) (in GD); 2 ♀♀, Saint-André-de-Bueges, Les Prats, 23 VIII 1990 (G. Delvare) (in GD); 1 ♀, Aniane, Pont-du-Diable, 31 V 1990 (G. Delvare) (in GD); 1 ♀, Saint-Etienne-d'Issensac, 23 VIII 1990 (G. Delvare) (in GD); 1 ♀, St-Bauzille-de-Montmel, on an ootheca of *Mantis religiosa*, 19 IV 1984 (G. Delvare) (in GD); 5 ♀♀, Grabels, on an ootheca of *Empusa pennata*, Grabels, 19 VII 1993 (J.-M. Males) (in GD); 16 ♀♀ 3 ♂♂, Grabels, ex *E. pennata*, 19 VII 1993, adult emergency on 1–2 VIII 1993 (J.-M. Males) (in NHM, MNHN, GD); Montpellier, campus Cirad, 17 ♀♀ 1 ♂, ex *E. pennata*, 15 VIII 1998, emergence on 24 VIII 1998 (J.-M. Males) (in GD); 8 ♀♀ 3 ♂♂, Cazevielle, ex *M. religiosa*, 6 V 1988 (G. Delvare) (in GD); 1 ♀, Cazevielle, 13 VII 1984 (G. Delvare) (in GD); 1 ♀, Viols-le-Fort, 29 VII 1990 (G. Delvare) (in GD); 2 ♀♀, Saint-Martin-de-Londres, Frouzet, 16 VI 1990 (G. Delvare) (in GD); Gard, 1 ♀, Blandas, 24 VI 1989 (G. Delvare) (in GD); Ardeche, 6 ♀♀, Vallon-Pont-d'Arc, ex *M. religiosa*, 7 IV 1984 (H.-P. Aberlenc) (in GD); 1 ♀, same locality and collector, 16 VIII 1984, Malaise trap (in GD); Gard, 3 ♀♀, Crespien, 30 VI/5 VII 1980 (M.J. Gijswijt) (in ZMUA); 1 ♀, Crupies, 7 VIII 1974 (M.J. Gijswijt) (in ZMUA);) Drôme, 2 ♀♀, Buis-les-Baronnies, 6 VIII 1992 (G. Delvare) (in GD); 1 ♀, Saou, 30 VIII 1981 (M.J. Gijswijt) (in ZMUA); Vaucluse, 1 ♀, Beaumont, 4 X 1985 (M.J. Gijswijt) (in ZMUA); 1 ♀, Viens, 29 VII 1974 (M.J. Gijswijt) (in ZMUA); 1 ♀, Entrechaux, 28 VII 1973 (M.J. Gijswijt) (in ZMUA); 1 ♀, Lourmarain, 26/28 VII 1974 (M.J. Gijswijt) (in ZMUA); Vaucluse, 1 ♀, Bédoin, 350–435 m, 11 VIII 1992 (G. Delvare) (in GD); CORSICA, 1 ♀, Porto Vecchio, 9 VII 1990 (J.-Y. Rasplus) (in JYR).



Figs 2–10. Heads of *Podagrion* spp., all in frontal view. 2 – male of *Podagrion bouceki* sp. nov.; 3 – female of *P. gibbum* Bernard; 4 – male of *P. pachymerum* (Walker); 5 – female of *P. bouceki* sp. nov.; 6 – female of *P. gibbum*; 7 – female of *P. klugianum* (Westwood); 8 – female of *P. pachymerum*; 9 – female of *P. minus* Strand; 10 – female of *P. splendens* Spinola.

ADDITIONAL MATERIAL EXAMINED FROM THE PALEARCTIC REGION. MOROCCO: 3 ♀♀, Taghazoute (20 km N Agadir), 8 V 1989 (H. Tussac) (in GD); 3 ♀♀, Moulay Idriss, Volubilis, 3/4 VI 1992 (G. Delvare) (in GD); 14 ♀♀, same locality, 17 IV 1995 (H. Tussac) (in GD); 3 ♀♀, Ain Chkeff (near Meknes), 29 VI 1984, ex *Sphodromantis viridis* (J.-F. Vayssieres) (in GD); 5 ♀♀, Oued Sebou (near Kénitra), 30 IV 1983, ex *S. viridis* (J.-M. Males) (in GD); 1 ♀ 2 ♂♂, Allal Tazi (near Kénitra), 30 IV 1983, ex *S. viridis* (J.-F. Vayssieres) (in GD). IRAN: 5 ♀♀, Djirofté, ex Mantidae, 1 I 1969 (Safavi) (in MNHN). OMAN: 1 ♀ 1 ♂, Naki, 19 X 1990 (Gallagher & Deeming) (in CNCI).

DESCRIPTION. Female 3–3.7 mm. Color variable, depending on host. Adults emerged from *Mantis religiosa* or *Sphodromantis* spp. have greenish to bluish reflections on head and mesosoma; the frons, laterally in front of lateral ocelli, has a characteristic area of delicate reticulation that is more brightly colored and blue, contrasting with the greenish surface of frons (Fig. 5). Gaster mostly dark, with small light spot dorsally. Scape, pedicel and funicle brown, clava dark brown. Fore and hind coxae concolorous with body, except apices, mid coxa dark brown. Fore and hind femora dark with slight metallic reflections. Mid femur and hind tibia brownish; other tibiae and tarsi testaceous. Veins brown. Pilosity on wings brown. Adults emerged from *Empusa* spp. darker, almost black; area of frons less obvious, with less contrasting coloration. Head and mesosoma with fine and fairly short, silvery hairs.

Head twice as broad as long in dorsal view, 0.83–0.90 as high as broad. Fronto-vertex about half as long as head width, slightly shorter than height of eye (32:36) (Fig. 5). Malar space half as long as eye height. Lower face and gena densely reticulate, becoming alutaceous near malar groove, latter almost straight. OOL as 0.70–1.1 times OD. Pedicel + flagellum 1.36–1.45 times as long as width of head (Fig. 15), F1 1.32–1.50 times (exceptionally 1.25) as long as broad and 0.75–0.95 times as long as pedicel, following segments progressively shorter; F7 0.61–0.72 times as long as broad.

Mesosoma 1.6–1.85 times as long as wide. Mesoscutum and scutellum respectively 1.65 and 0.9 times as wide as long. Notauli complete, reaching transscutal line although superficial posteriorly (Fig. 20). Frenal area quite distinct, smooth or nearly so, sometimes with extremely fine and superficial network. Propodeum with carinae forming an inverted V, distinctly curving outwards posteriorly, forming an obviously acute angle at base (20–60°) and a slight one at mid length of propodeum (70–90°) (Fig. 30); surface mostly reticulate to rugulose-reticulate, especially on adpetiolar area; not sloping much laterally; spiracle slightly longer than distance to hind margin of metanotum. Hind femur with 7–8 teeth, 2nd and 4–6th shorter. Cubital vein setose along basal cell, with 9–16 hairs; basal vein with 7–16 hairs (Fig. 18).

Ovipositor sheaths 1.25–1.4 times as long as body.

Male (heteromorph) 2.5–3 mm. Some coloration as female. Pedicel + flagellum 1.5–1.63 times as long as width of head. F1 1.6–2 times as long as wide. Frenal area reticulate, although more finely so than rest of scutellum. Propodeum rugulose-reticulate, carinae on a longer median branch (Fig. 33). Hind femur bearing 4 teeth, the penultimate one partly fused with the last tooth (Fig. 37). Cubital vein of forewing bearing 4–10 hairs.

NAME DERIVATION. Named in honour of Zdeněk Bouček, the world's foremost chalcidologist.

DISTRIBUTION. The species is common and widely distributed. In the Palearctic I examined specimens from Morocco, Portugal, Spain, France, Corsica, Greece, Oman and Iran. But it is also widely distributed in the afrotropical region. This distribution surprised me, but I could not find any morphological differences between the specimens collected in the Mediterranean Basin and West Africa for example, including structure of tergites and sternites (both sexes) and male genitalia. The dendrogram resulting from the clustering analysis in our morphometric study (Delvare 2002) showed that the afrotropical specimens are distributed together within the palearctic ones. In the subsaharian Africa, we examined specimens from Senegal, Gambia, Guinea, Burkina Faso, Ivory Coast, Benin, Cameroon, Somalia and South Africa.

HOSTS AND BIOLOGY. This species is especially attracted by *Empusa* spp., mainly *E. pennata* (Thunberg, 1815); my colleague J.-M. Maldès found 5 females trying to oviposit on the same egg-case. I left 7 *Empusa* egg-cases as sentinels on the CSIRO campus near Montpellier and 4 of these were parasitized by *Podagrion bouceki* sp. nov. The eggs of *Empusa* are the largest among those of the mantid species found in the mediterranean region. In the summer and early autumn it is often possible to collect adults of *Podagrion bouceki* sp. nov. whose size agrees with that of specimens reared in laboratory cultures on *Empusa*. In spring and early summer smaller specimens can be collected, which probably develop upon eggs of *Mantis religiosa* Linné, 1758, although this latter host was less frequently recovered. The species was also reared from *Sphodromantis viridis* (Forskål, 1775) in Northern Africa. It is therefore bivoltine in the mediterranean region: a summer generation on *Empusa* and a winter or spring generation on *Mantis religiosa* or *Sphodromantis viridis*.

***Podagrion gibbum* Bernard, 1938 stat. nov.**

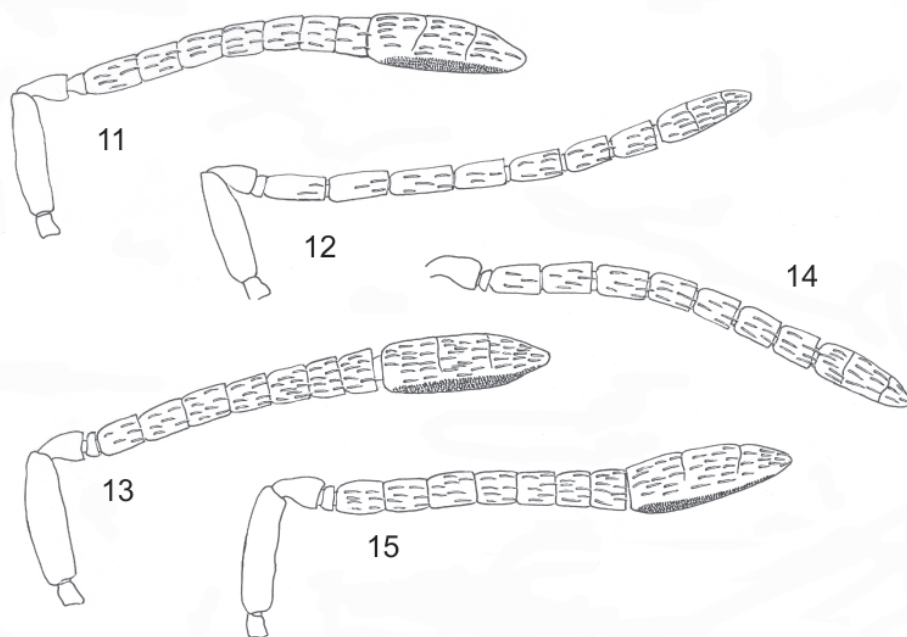
(Figs 3, 6, 17, 24, 32, 34, 38)

Podagrion pachymerum var. *gibba* Bernard, 1938: 42–45 (type locality: Banyuls [France]).

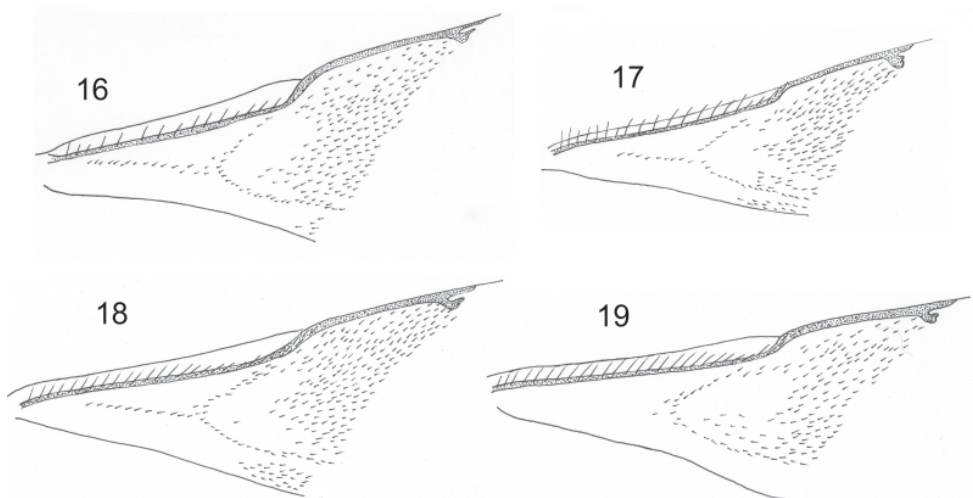
Podagrion pachymerum gibba: Grissell 1995: 244.

TYPE MATERIAL EXAMINED. Lectotype ♀, here designated, labelled „Banyuls/sortie empuse/éclos IX 36/F. Bernard“ (in MNHN). Paralectotypes, same references, 5 ♀♀ 2 ♂♂ (in MNHN) and 4 ♀♀ 1 ♂ (in MHNG).

ADDITIONAL MATERIAL EXAMINED. SPAIN: Granada, 1 ♂, Southern slope of Sierra Nevada, Trévez, 8 VI 1994 (G. Delvare) (in GD). FRANCE: Hérault, 19 ♀♀ 2 ♂♂, Cazeville, ex *Iris oratoria*, 6 V 1988, adult emergence on 10 V 1988 (in GD); 1 ♂, Saint-Jean-de-Buèges, 17 VI 2000 (G. Delvare) (in GD); Bouches-du-Rhône, 1 ♀, Saint-Martin-de-Crau, ex *I. oratoria*, 17 V 1999, (A. Foucart) (in GD); 10 ♀♀ 3 ♂♂, same data but ex *Ameles decolor*. GREECE: Mani, 8 ♀♀ 3 ♂♂, Marmaria, ex *Ameles spallanzania*, 16 IV 1997, emergence on 22 V



Figs 11–15. Antennae of *Podagrion* spp. 11–12, female and male, respectively of *Podagrion pachymerum* Walker; Figs 13–14, female and male, respectively of *P. splendens* Spinola; Fig. 15, female of *P. bouceki* sp. nov.

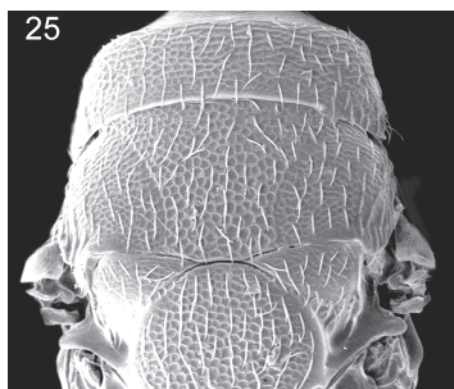
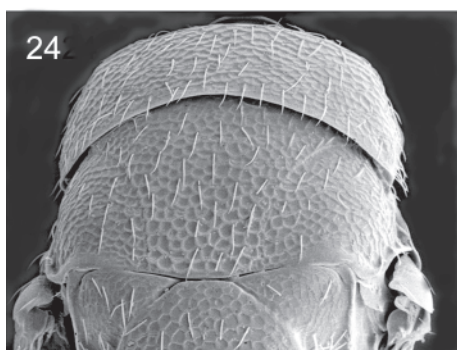
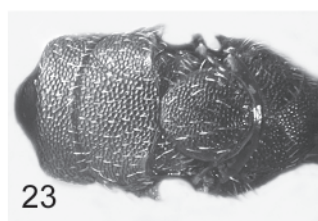
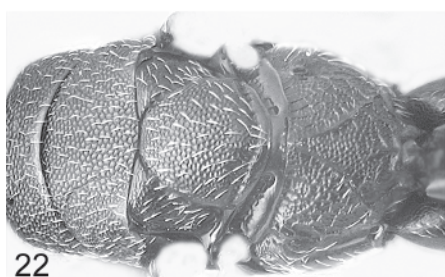
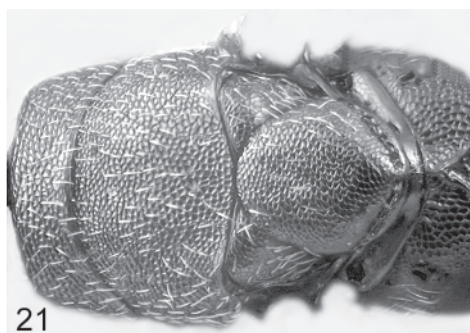


Figs 16–19. Forewing bases of *Podagrion* spp., females. 16 – *P. pachymerum* Walker; 17 – *P. gibbum* Bernard; 18 – *P. bouceki* sp. nov.; 19 – *P. splendens* Spinola.

1997 (J.-M. Maldes) (in GD); Ahaia, 1 ♀, 7 km SW Dervéni, 6 VI 1989 (M.J. Gijswijt) (in ZMUA); Arkadia, 1 ♀, 1 ♂, Ág. Pétros, 1,000 m, 24 IV 1989 (M.J. Gijswijt) (in ZMUA); Argolida, 1 ♂, Mikines, 20 IV 1989 (M.J. Gijswijt) (in ZMUA).

REMARKS. The series of specimens from which a lectotype is designated was housed in MNHN within a box labelled “types de Ferrière”; the specimens did not bear any type labels. However the data provided on the labels completely agrees with the information provided by Bernard (1938) together with the description of *Podagrion pachymerum* var. *gibba*: “L’oothèque d’*Empusa ege-na* [a junior synonym of *Empusa pennata*], si reconnaissable à son fil dressé .../... En 1935 et 1936, j’ai réuni des pontes récoltées à Fréjus (Var) et Banyuls (Pyrénées-Orientales) .../... et 3 seulement d’*Empuse* .../... La troisième, prise en août, .../... était entièrement attaquée par des Chalcidiens .../... il en est sorti .../... 5 ♂ et 13 ♀ du genre *Podagrion*.”. This type designation is essential because the original description is inaccurate to distinguish the species from the other *Podagrion*, and also to point out the importance of this series which otherwise would have been overlooked.

DIAGNOSIS. Small size species: Female 2.3–2.8 mm. Head and mesosoma almost black; lower face with slight greenish reflections. Mesosoma sometimes with slight bronze reflections. Hind femur reddish to dark brown, rarely with metallic reflections. Head relatively transverse in dorsal view, 1.75–2.1 times as wide as long. OOL larger than OD ($\times 1.2$ –1.4) (Fig. 6). Lower face uniformly and finely reticulate without a subtorular area of squamose sculpture. Flagellum short, together with pedicel 1.25–1.4 times as long as width of head. Notauli complete, clearly distinct throughout (Fig. 24). Scutellar disc not much convex. Frenal area visible as a completely smooth area, abruptly delimited anteriorly. Propodeal carinae forming an inverted Y, with short median branch; oblique carinae straight to very slightly curving outwards, forming together a slightly acute angle at base, and a right to obtuse angle at mid length of propodeum (Fig. 32); propodeal surface reticulate to rugulose-reticulate; spiracle relatively short, hardly as long as its distance to hind margin of



Figs. 20–23. Mesosoma of *Podagrion* spp., females (20–23). 20 – *Podagrion bouceki* sp. nov.; 21 – *P. klu-gianum* (Westwood); 22 – *P. splendens* Spinola; 23 – *P. minus* Strand. Mesoscutum, respectively (24, 25). 24 – *P. gibbum* Bernard; 25 – *P. pachymerum* (Walker).

metanotum; spiracular groove not much deep. Hind femur bearing 6–7 teeth ventrally. Cubital vein of fore wing setose along basal cell (5–10 hairs), basal vein bearing 5–9 hairs (Fig. 17). Ovipositor relatively short, ovipositor sheaths only 1–1.25 times as long as body.

Male (heteromorph). 2.1–2.9 mm. Similar as female except as follows: Head and mesosoma with more greenish reflections. Legs, except hind coxae and part of mid coxae reddish-brown. Head less transverse in dorsal view. Adscrobal area with coarser reticulation dorsally. Pedicel + flagellum 1.65–1.7 times as long as head width. Frenal area delicately reticulate. Propodeal carinae originating from a longer median branch (Fig. 34). Penultimate tooth of hind femur completely separated from the terminal one (Fig. 38).

RECOGNITION. This species is distinguished by its small size, short ovipositor, reddish hind femur, complete notauli and distinct frenal area, mostly straight propodeal carinae forming together a slightly acute to right angle, and setose cubital vein. Because of this small size it is superficially similar to *Podagrion minus*, but this latter species has incomplete notauli, indistinct frenal area and bare cubital vein. Large females of *P. gibbum* (emerged from *Empusa pennata*) have the propodeal carinae forming a more acute angle and moderately curving outwards posteriorly, and therefore might be mistaken for *Podagrion bouceki* sp. nov. because. In *P. bouceki* sp. nov., however, the OOL is distinctly shorter and the hind femur is dark, with metallic reflections.

DISTRIBUTION. I have seen specimens from Spain, France and Greece in Europe. Probably present in the whole northern part of the Mediterranean Basin, possibly in the southern part.

HOSTS. Mostly reared from *Iris oratoria* (Linné, 1758), *Ameles decolor* (Charpentier, 1825) and *A. spallanzania* (Rossi, 1792); the type series came from an egg-case of *Empusa pennata* but this event was never repeated since then, although *Empusa* egg-cases were collected a number of times in various countries from the Mediterranean region.

***Podagrion klugianum* (Westwood, 1847)**

(Figs 7, 21, 27, 35, 47–49)

Palmon (Pachytomus) Klugianus Westwood, 1847: 260 (type locality: Egypt).

Priomerus insidiosus Coquerel, 1856: 507 (type locality: La Réunion [= Bourbon]) [erroneously synonymized with *Palmon fraterum* Westwood, 1847 by Dalla Torre 1898: 369]; **syn. nov.**

Coquerelia insidiosa Saussure in Grandidier, 1890: pl. 20, fig. 7 (type locality: Madagascar).

Podagrion klugianum: Dalla Torre 1898: 369, Grissell 1995: 240.

Coquereliana insidiosa: Gahan & Fagan 1923: 39.

Podagrion meridionale Masi, 1935: 68–71 (type locality: Tarda [Morocco]); **syn. nov.**

Podagrion insidiosa: Masi, 1940: 251.

Podagrion armigerum Masi, 1940: 251, 254–257 (type locality: Villagio Duca degli Abruzzi [Somalia]); **syn. nov.**

Podagrion tarachodesi Risbec, 1951: 312–313 (type locality: Abengourou [Ivory Coast]); **syn. nov.**

Podagrion sphodromantidis Risbec 1951: 313 [part, misidentification].

Podagrion enei Bakkendorf, 1960: 364–368 (type locality: Ibadan [Nigeria]); **syn. nov.**

Podagrion armigerum: Grissell 1995: 235.

Podagrion enei: Grissell 1995: 237–238.

Priomerus insidiosus Coquerel [as a synonym of *Podagrion fraterum* Westwood]: Grissell 1995: 238.

Podagrion meridionale: Grissell 1995: 242.

Podagrion tarachodesi: Grissell 1995: 248.

TYPE MATERIAL EXAMINED. *Palmon (Pachytomus) Klugianus*. Lectotype ♂, designated by Graham and validated by Grissell (1995: 240). The type is glued on a squared card and labelled „ex Ficulus Aegypti/Dr. Klug/N°62/ posterior tarsi similar when perfect to anterior 4“ „W“ [blue label] „Palmon (Pachytomus) Klugianum Westwood/M. de V. Graham det. 1970/Lectotype ♂“ (OUM Type N° 1346).

Priomerus insidiosus. ♀ neotype, here designated: LA REUNION: Chemin de Grand Bassin, ex mantid egg case (RQ 2948), 1994 (Quilici S.).

Podagrion meridionale. Lectotype, here designated, a ♀ labelled „♀ 12/Tarda/Maroc/Coll. Rungs“ and „Podagrion meridionale Ms./cotypi !/det. L. Masi“ (in MSNG).

Podagrion armigerum. Lectotype, here designated, a ♀ glued on a card [remounted] and labelled „Vill. Duca Abruzzi/1930/Russo“ „da ooteche di Mantidi“ „Museo Civico di Genova“ „Cotypi“ and „Podagrion armigerum MS ♀♂“ (in MSNG).

Podagrion tarachodesi. Lectotype, here designated, a ♀ extracted from a slide labelled in Risbec's handwriting „ex Tarachodes sp./Bambey/Podagrion tarachodesi Risbec“ (in MNHN). Paralectotypes. 5 ♀♀, same data as Lectotype; 23 ♀♀ 16 ♂♂ [from IVORY COAST: Abengourou], labelled „301c/Dagatiguy/ex ponte Mantis gastrica/Podagrion tarachodesi Risbec“ (in MNHN).

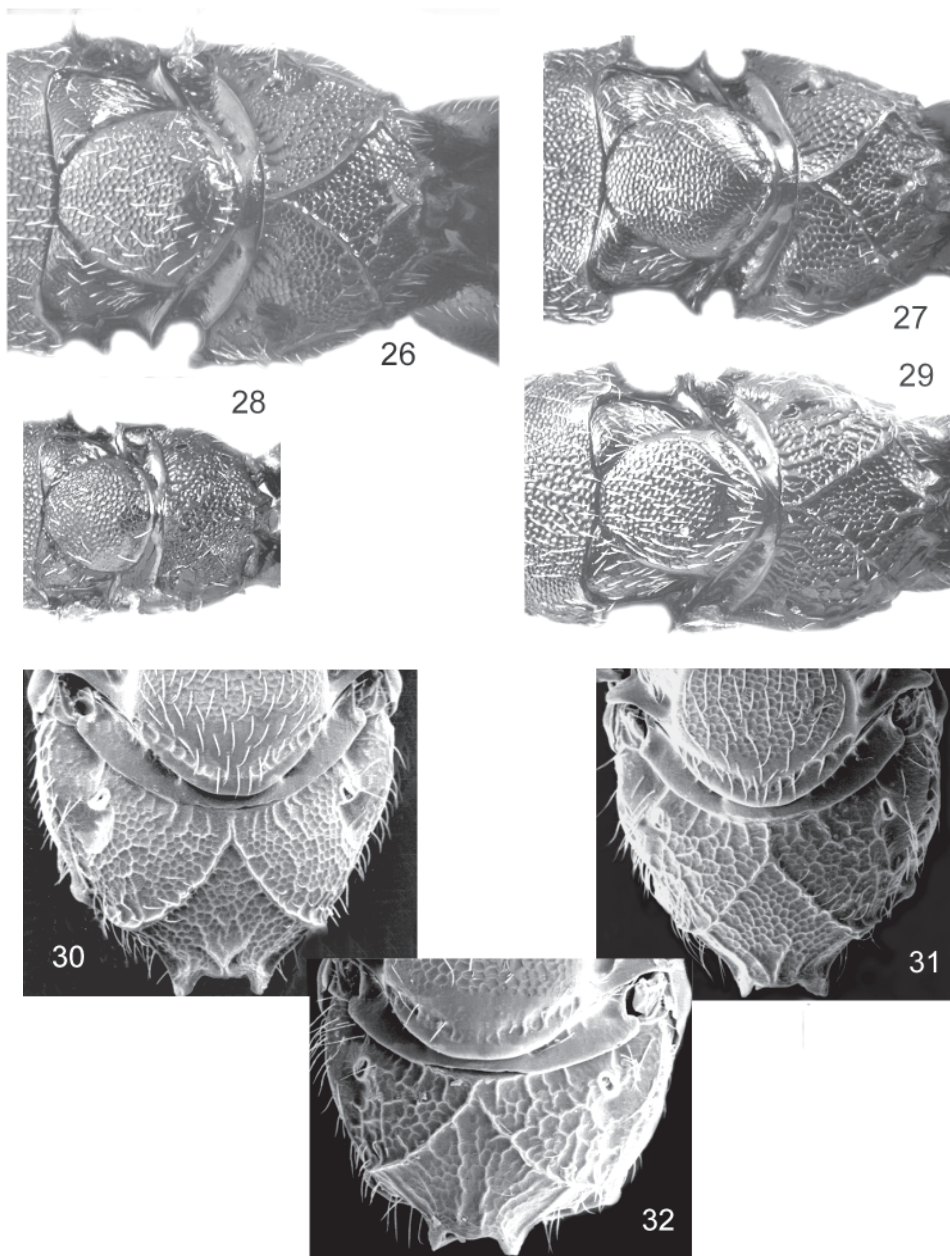
Podagrion enei. Holotype and allotype (on slides !)(in ZMUC).

ADDITIONAL PALEARCTIC MATERIAL EXAMINED. MOROCCO: 2 ♀♀, Rabat, ex a Mantodea egg-case (D. Lépiney) (in NHM); 1 ♂, Oasis de Tarda (Régner) [this specimen belongs to the original series of *Podagrion meridionale* which was partly sent to Masi, partly to Ferriere]; 2 ♀♀, Kénitra, *Quercus suber* forest, 12 IV 1995 (H. Tussac) (in GD); 3

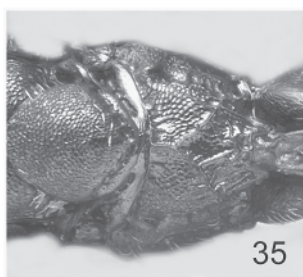
♀♀ 3 ♂♂, Ain Chkeff [near Meknes], 29 VI 1984, ex *Sphodromantis viridis* (J.-F. Vayssieres) (in GD); 2 ♂♂, Moulay Idriss, 4 VI 1992 (G. Delvare) (in GD); 1 ♂, Moulay Idriss, Volubilis, 17 IV 1995 (H. Tussac) (in GD); 1 ♀, Agadir, 14 IV 1995 (H. Tussac) (in GD). TUNISIA: 1 ♀, Hammamet, 14 V 1999 (H. Tussac) (in GD). CYPRUS: 1 ♀, Yermasoyia Riv., 13 X 1967 (G.A. Mavromoustakis) (in CNCI). ISRAEL: 1 ♀ 1 ♂, Tel Aviv, XII 1968, ex *S. viridis* (D. Gerling) [identified as *P. meridionale* by J.-R. Steffan] (in MNHN); 1 ♀, same data (in NHM) [identified as *P. klugianum* by Z. Bouček]; 1 ♀ 1 ♂, Daganya, Jordan Valley, ex *Mantis religiosa* (V. Palmoni) (in NHM). EGYPT: 3 ♀♀ 1 ♂, Alexandria, 1974, ex Mantodea eggs (T.F. Alawi) (in NHM).

REMARKS. *Priomerus insidiosus* was apparently and wrongly synonymized with *Palmon fraternus* Westwood by Dalla Torre (1898). Saussure (1890) figured it as *Coquerelia insidiosa*; it became therefore the type species of *Coquerelia*. No specimens from the original series could be found in MNHN, where they should have been housed, in spite of a careful examination of the whole chalcidoid collection. Because of the confusion regarding the identity of this species, it is essential to clarify its status, and a neotype designation is proposed for this purpose. The neotype agrees with the figure provided by Coquerel (1856: pl. 15) and the type locality: Coquerel described the species from Reunion island. Moreover Coquerel mentioned it as a phoretic species, which is false, according to Gerling (1965): Coquerel mentioned having observed females ovipositing eggs in fresh oothecae, in the same time as the mantid female did; Gerling conversely found that females of *P. klugianum* [as *P. meridionale*] did oviposit in old egg-cases. The phoretic species is therefore different from *P. insidiosus* and this is another reason to settle the identity of *Priomerus insidiosus*. Lectotypes are also proposed for the species described by Masi to ensure their identity and taxonomic status. Risbec (1951) described *P. tarachodesi* from a number of series reared from different hosts. This author often misidentified several species under the same name and this was the case here. Therefore a lectotype designation is essential to establish the identity of *P. tarachodesi*. I could not find any reliable morphological differences between the populations from the palearctics and those from subsaharian Africa which would support the segregation of different species. There is however some subtle variation among allopatric populations which can be used to keep some of the above names at a subspecific level. The nominal subspecies *P. klugianum* ssp. *klugianum* is distributed in the Palearctic Region (mostly southern Mediterranean Basin and Middle East) and its usual host is *Sphodromantis viridis*, rarely *Mantis religiosa*. Females have the mesosoma more greenish and the ovipositor shorter (1.5–1.7 times as long as the body). The subspecies *P. klugianum* ssp. *tarachodesi* stat. nov. is found in West and Central Africa, and mostly parasitizes there *Sphodromantis lineola* and sometimes *Tarachodes saussurei*. Females of this subspecies have the mesosoma greenish to bluish, the adpetiolar area of the propodeum is more brightly bluish and the ovipositor longer: 1.7–2 times as long as the body. A third subspecies, *P. klugianum* ssp. *armigerum* stat. nov. is found in East Africa; it is mostly similar to *tarachodesi* but here the angle formed by the propodeal carinae is less acute (Figs 48–49). At last *P. klugianum* ssp. *insidiosum* stat. nov. inhabits Southern Africa, Madagascar and the Mascareign Islands; females of this subspecies have the body dark bluish and the longest ovipositor for the species: at least 2 times as long as the body; its host in this area is mostly *Polyspilota aeruginosa*.

DIAGNOSIS. Female 3–3.5 mm (excluding ovipositor). Species of medium size, with greenish to bluish reflections on mesosoma; head more bluish with frons often having an area of still more bluish color laterally. Lower face more greenish laterally. Antenna with funicle generally lighter than clava (brownish to testaceous *versus* dark brown). Hind femur dark with metallic reflections on outer side, hind tibia brownish. Head less than twice as broad as long in dorsal view ($\times 1.6$ – 1.9) (Fig. 7). Outline of frons, when seen in dorsal view, distinctly convex. Head without area of delicate sculpture on frons laterally (although the reticulation is everywhere fine). Notauli completely absent posteriorly, even as change in sculpture (Fig. 21). Lateral lobes of mesoscutum distinct



Figs 26–32. Scutellum and propodeum of *Podagrion* spp., females. 26 – *Podagrion bouceki* sp. nov.; 27 – *P. klugianum* (Westwood); 28 – *P. minus* Strand, 29 – *P. pachymerum* (Walker), 30 – *P. bouceki* sp. nov.; 31 – *P. pachymerum*; 32 – *P. gibbum* Bernard.



Figs 33–36. Propodeum of *Podagrion* spp., males. 33 – *Podagrion bouceki* sp. nov.; 34 – *P. gibbum* Bernard; 35 – *P. klugianum* (Westwood); 36 – *P. pachymerum* (Walker).

from median lobe through change in sculpture only. Axillar grooves narrow but deep. Scutellum evenly convex, showing no frenal area, the apex of scutellum being reticulate (Fig. 27). Propodeum with lateral carinae joining on a very short median one, slightly curving outwards posteriorly; apetiolar area delimited laterally by sublateral costulae; anterolateral areas of propodeum reticulate, adpetiolar area more or less rugose-reticulate; spiracle fairly long; spiracular groove moderately deep, delimited by a fine and regular carina, areolate. Hind femur bearing 7–8 teeth ventrally. Cubital vein of forewing completely bare along basal cell, basal vein bearing 7–8 hairs. Ovipositor sheaths very long, at least 1.5 times as long as the body but frequently more ($\times 1.7$ times) and in tropical Africa up to 2 times as long.

Male (heteromorph) 2.5–3.4 mm. Similar as female except as follows: Color more greenish, with bronze reflections. Scutellum more convex. Propodeal carinae forming an inverted Y; adpetiolar area quite

rugose, contrasting with the antero-lateral areas; propodeum obviously sloping laterally; spiracular groove deep (Fig. 35). Penultimate tooth of hind femur distinctly separated from the last one.

RECOGNITION. This species is distinguished by the combination of incomplete notauli, absence of frenal area, morphology of the propodeum, teeth of the hind femur and long ovipositor. In the Palearctics it cannot be misidentified for any other species.

DISTRIBUTION. Palearctics: Morocco, Tunisia, Egypt, Israel, Cyprus. Afrotropics: Capo Verde, Senegal, Mali, Chad, Burkina Faso, Guinea, Sierra Leone, Liberia, Ivory Coast, Ghana, Benin, Nigeria, Cameroon, Congo, Ethiopia, Somalia, Kenya, Mozambique, South Africa, Madagascar, La Reunion, Mauritius. This is one of the commonest species in Africa and it is easy to rear because the egg-cases of its hosts are well visible, deposited on bushes and branches.

HOSTS AND BIOLOGY. *Mantis religiosa*, *Sphodromantis viridis* (in the Palearctics); *S. lineola* (Burmeister, 1838), *Tenodera superstitiosa* (Fabricius, 1781) and *Polyspilota aeruginosa* (Goeze, 1778) in subsaharian Africa. Gerling (1965) described the oviposition behaviour.

***Podagrion lybicum* Masi, 1929**

(Figs 42, 43)

Podagrion lybicum Masi, 1929: 221–222 (type locality: Oasis of Giarabub [Lybia]); Grissell 1995: 240–241.

TYPE MATERIAL EXAMINED. Holotype ♂ [not ♀ as erroneously quoted in the description] (in MSNG).

DIAGNOSIS. Male 2.8 mm. Body dark with the following metallic reflections: head, pro-, meso- and metanotum coppery; metapleuron and propodeum bluish. Coxae and hind femur concolorous with mesonotum. Head 1.83 times as broad as wide (56:30.5). OOL shorter than OD (4.5:6). Gena delicately but completely reticulate, the cells isoedric near malar groove, elongate near occipital carina. Flagellum missing on the type. Mesonotum with similar reticulation over entire surface. Notauli complete and clearly distinct throughout. Scutellum about as long as wide (30:29), fairly convex. Axillar grooves relatively broad. Frenal area present, nearly smooth (very delicate reticulation hardly visible). Propodeum with carinae as an inverted Y: the lateral carinae together form a right angle, and originate on a short median branch (Fig. 43); spiracular groove deep; spiracle elongate; propodeum mostly reticulate, but showing some rugulae at its anterior margin and within the adpetiolar area. Hind coxa relatively short. Hind femur very large, 1.85 times as long as wide and with 6 strong teeth (Fig. 42). Cubital vein of fore wing bare along basal cell; basal vein with 9 hairs.

RECOGNITION. Unfortunately the species is known only from the male holotype and we did not discover any female which could be associated with it. It can be separated from other *Podagrion* spp. by the following combination of characters: complete notauli, distinct frenal area, convex scutellum, short propodeum with carinae forming a right angle and broad hind femur.

DISTRIBUTION. Lybia.

HOSTS. Unknown.

***Podagrion minus* Strand, 1911**

(Figs 9, 23, 28, 39, 44–46)

Podagrion minus Strand, 1911: 158–159 (type locality: Lucca [Italy]; Grissell 1995: 243.

TYPE MATERIAL EXAMINED. Holotype ♀ (in ZMHB).

ADDITIONAL MATERIAL EXAMINED. SPAIN: Almería, 1 ♀, Nijar, Sierra de Alhamilla, 14 VI 1994 (G. Delvare) (in GD); Murcia, 1 ♂, autoroad way out to Sorbas, sweeping *Retama sphaerocarpa*, 5 VI 1994 (G. Delvare) (in GD); Madrid, 1 ♀, Vaciamadrid (G. Mercet) (in MNM); 1 ♂, Escorial (Cabrera) (in MNM). MOROCCO: 2 ♀♀, Oued Ourika, High Atlas, Marrakech Region, V 1983, ex *Sphodromantis viridis* (J.-M. Maldès) (in GD).

DIAGNOSIS. Female of small size: 2–2.15 mm. Coloration mostly similar to that of *P. splendens* but hind femur reddish-testaceous. Head about 2 times as broad as long (Fig. 9). Anterior outline of frons fairly convex when seen in dorsal view. OOL greater ($\times 1.3$) than OD. Flagellum short, combined with the pedicellus only 1.35 times as long as width of head (Fig. 44). Mid lobe of mesoscutum reticulate, becoming squamose on lateral lobes. Notauli visible over two thirds length of mesoscutum (Fig. 23). Axillar grooves narrow anteriorly. Frenal area very indistinct, only slightly more delicately reticulate than anterior part of scutellum, the latter broadly rounded posteriorly (Fig. 28). Propodeum with carinae forming together a right to slightly acute angle, originating on a short median branch (latter sometimes missing), straight or slightly curving outwards; spiracle short, elliptical (Fig. 45); spiracular groove not much deep; propodeum surface mostly reticulate. Hind femur with 5–7 teeth (Fig. 46). Cubital vein of fore wing bare along basal cell, basal vein with 7–8 hairs. Ovipositor sheaths 1.1–1.26 times as long as body.

Male. The only associate male, not typical heteromorph, has 5 teeth on the hind femur, with last 2 teeth being separated (Fig. 39). The propodeal carinae are straight but originate on a longer median carina than in female.

RECOGNITION. *Podagrion minus* is distinguished by its small size, reddish hind femur, ornamentation of propodeum, incomplete notauli and indistinct frenal area. It is superficially similar to *P. gibbum* but the latter species has complete notauli, a distinct frenal area and setose cubital vein. Small specimens of *P. splendens* can be difficult to separate from *P. minus* because the propodeal ornamentation approaches that of latter species. In *P. splendens* however the OOL is shorter and the hind femur is dark with slight metallic reflections.

DISTRIBUTION. This species is apparently rare and i found in the western Mediterranean Basin: Morocco, Spain, Italy.

HOST. The species was reared once from *Sphodromantis viridis*; this record is surprising because the females have a short ovipositor while the spongy cover of that mantid egg-case is quite thick. *S. viridis* may be a marginal host because only 2 adults were reared and the consistantly small size of collected specimens of *Podagrion minus* suggests that it parasitizes small mantids belonging to the subfamily Amelinae.

***Podagrion pachymerum* (Walker, 1833)**

(Figs 4, 8, 11, 12, 16, 25, 29, 31, 36, 41)

Priomerus pachymerus Walker, 1833: 118 (type locality: South of France).

Palmon religiosus Westwood, 1847: 259 [no country quoted in original description; apparently synonymized by Mayr (1874: 63)].

? *Bactyrishion bicoloratum* Costa, 1857: 226 [apparently synonymized by Mayr (1874: 63)].

Podagrion pachymerum var. *rufiventre* Giraud, 1863: 1311 (type locality: Austria (near Vienna); **syn. nov.**

Podagrion splendidum Walker, 1871: 19. [lapsus for *P. splendens*; see Grissell (1995: 244)].

Cleptimorpha binotata Walker, 1872b: 84–85 (type locality: Madeira); **syn. nov.** [considered synonym by Graham, pers. comm. and validated here].

Podagrion pachymerum: Dalla Torre 1898: 370; Chopard 1922: 265–271; Picard 1936: 468–472; Eady 1959: 270; Bouček 1976: 182; Grissell 1995: 244–245.

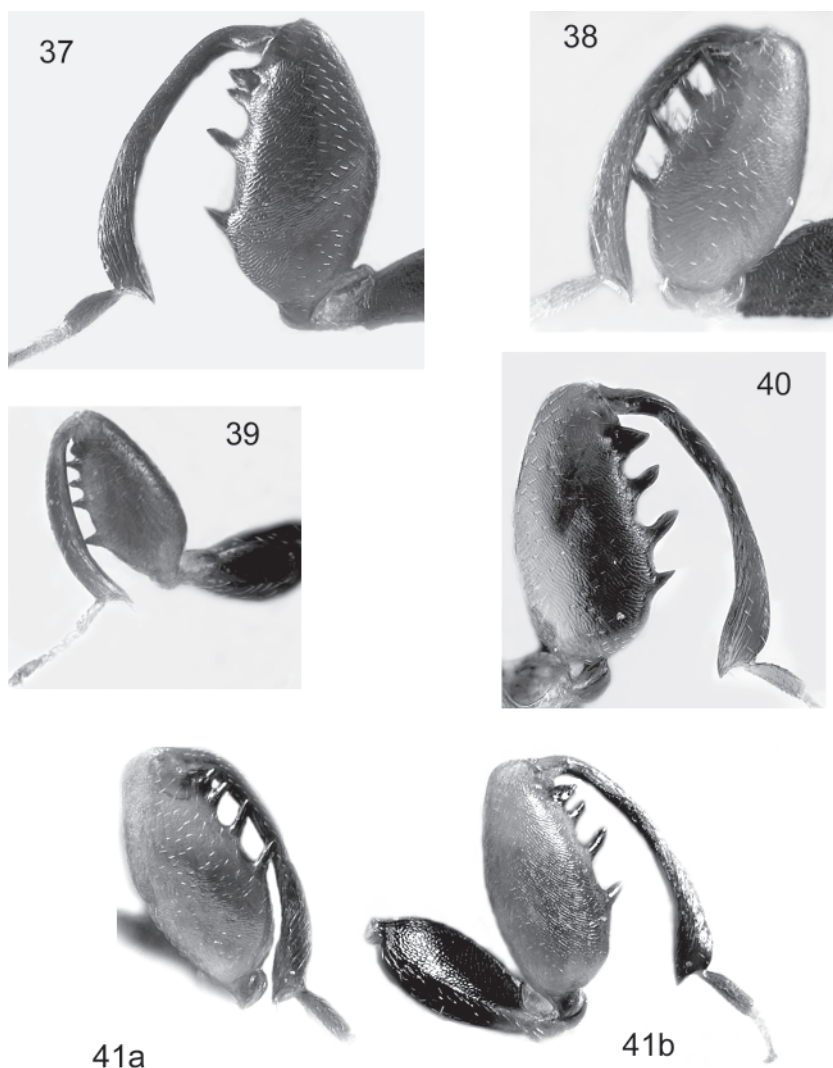
Podagrion bellator: Nikol'skaya 1952: 110 [misidentification].

TYPE MATERIAL EXAMINED. *Priomerus pachymerus*. Lectotype ♀, designated by Eady (1959: 270) labelled „S. France“ and bearing a Waterhouse label „Palmon pachymerus Walker“ (BMNH, Hym. Type 5–1626).

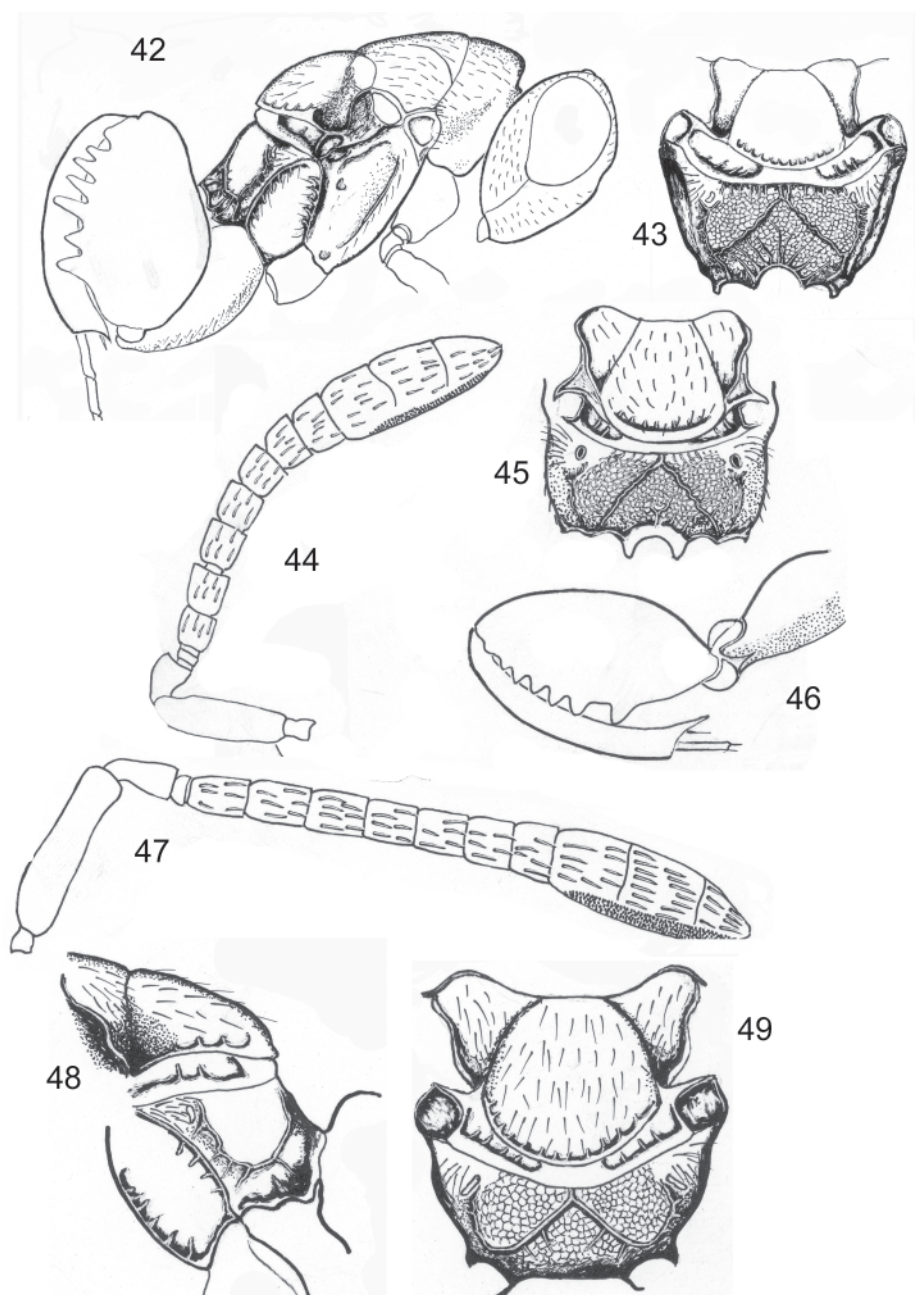
Podagrion pachymerum var. *rufiventre*. Lectotype, here designated, a pinned ♀ from the Giraud's Collection with the following handwritten labels „Podagrion splendens“ and „Palmon pachymerus var. rufiventris Giraud“ (in MNHN). Paralectotypes. Another ♀ and a ♂, from the same series.

Cleptimorpha binotata. Neotype ♀, designated by Graham (pers. comm.) and validated here; it is labelled „Madeira: Pico da Cruz/Funchal/3 II 1980/M. Koponen“.

ADDITIONAL MATERIAL EXAMINED. SPAIN: Almeria, 1 ♀, 15 km N Tabernas, 30 IV 1995 (M.J. Gijswijt) (in ZMUA); 1 ♀, Beires, Barranco de las Navas, 1,000 m, 7 VI 1994 (G. Delvare) (in GD); 1 ♀, Mojacar, Sierra Cabrera, 26 IV 1994 (M.J. Gijswijt) (in ZMUA); Valencia, 1 ♀, Valencia (Moroder) (in MNM); 1 ♀, same locality (G. Mercet) (in MNM); Castillon, 1 ♀, Navajas, 11 V 1989 (J.-Y. Rasplus) (in JYR); Avila, 1 ♀ 1 ♂, Candeleda, 24/30 VI 1986 (M.J. Gijswijt) (in ZMUA); Soria, 1 ♀, 15 km S Le Burgo de Osma, 3 VII 1990 (M.J. Gijswijt) (in ZMUA); Zaragoza, 1 ♀, Nuevalos, 700 m, 13 VII 1994 (F. Fontal) (in MNM); 1 ♀, Majamar, 6 X 1910 (in MNM); Madrid, 1 ♀, Vaciamadrid (Dusmet) (in MNM); 3 ♀♀, Escorial (Cabrera) (in MNM); Tarragona, 1 ♀, Cabo Salou, 16/28 VI



Figs 37–41. *Podagrion* spp., hind femur of heteromorph males. 37 – *Podagrion bouceki* sp. nov., 38 – *P. gibbum* Bernard; 39 – *P. minus* Strand; 40 – *P. splendens* Spinola; 41a & b – *P. pachymerum* (Walker). Figs 37–41. *Podagrion* spp., hind femur of heteromorph males. 37 – *Podagrion bouceki* sp. nov., 38 – *P. gibbum*; 39 – *P. minus*; 40 – *P. splendens*; 41a & b – *P. pachymerum*.



Figs 42–43. *Podagrion lybicum* Masi, male holotype. 42 – head and mesosoma in lateral view; 43 – propodeum. Figs 44–46. *Podagrion minus* Strand, female. 44 – antenna, 45 – propodeum, 46 – hind femur, Figs 47–49. *Podagrion klugianum* (Westwood), female. 47 – antenna, 48 & 49 – Holotype of *P. armigerum* Masi, propodeum, respectively in lateral and dorsal view.

1966 (G. van Rossem) (in ZMUA); Girona, 1 ♀, Roses, 7 VI 1990 (H. Tussac) (in GD). FRANCE: Morbihan, 4 ♀♀ 2 ♂♂, ex *Mantis religiosa* (Alexandre F.) (in GD); Haut-Rhin, 6 ♀♀ 2 ♂♂, Bollenberg, 363 m, ex *M. religiosa* (Hugel S.) (in GD); Vendée: 1 ♀, Yeu, VIII 1984 (Tiberghien) (in JYR); Dordogne, Plazac, 12 VIII 1991 (J.-R. Rasplus) (in JYR); Lot, 1 ♀, Brengues, 21 VII 1984 (H. Tussac) (in GD); 1 ♀, Cahors, 18 IX 1990 (H. Tussac) (in GD); Lozère, 1 ♀, Meyrueis, 16 VII 1991 (J.-Y. Rasplus) (in JYR); Hérault, 2 ♀♀, Portiragnes, La Redoute, 16/17 VIII 1986 (G. Delvare) (in GD); 37 ♀♀ 9 ♂♂, Aumelas, ex *M. religiosa*, 8 V 1994 (J.-M. Males) (in GD); 82 ♀♀ 29 ♂♂, Aumelas, Château-Bas, ex *M. religiosa*, 27 IV 1997 (T. Guilloux) (in GD); 13 ♀♀ 2 ♂♂, Puéchabon, les Chambrettes, ex *M. religiosa* (J.-M. Males); 2 ♀♀ 2 ♂♂, Cazevieille, 31 III 1985, ex *M. religiosa* (G. Delvare) (in GD); 16 ♀♀, same data but 6 V 1988; 3 ♂♂, same data but ex *Iris oratoria* (in GD); 1 ♀, Saint-Martin-de-Londres, 16 VI 1990 (G. Delvare) (in GD); 1 ♀, Grabels, 15 IV 1989 (H. Tussac) (in GD); 1 ♀, Montferrier-sur-Lez, 4 V 1984 (G. Delvare) (in GD); 5 ♀♀, same locality, CIRAD campus, 11/30 V 1979 (J.-M. Males) (in GD); 1 ♀, Pégairolles-de-Bueges, 21 IV 1984 (G. Delvare) (in GD); 1 ♀, Saint-Guilhem-le Désert, Les Lavagnes, 500 m, 13 IX 1989 (G. Delvare) (in GD); 1 ♀, same data but 18 IV 1993 (in GD); 3 ♀♀ 5 ♂♂, St-Jean-de-Bueges, 1 I 1985, ex *M. religiosa* (G. Delvare) (in GD); 1 ♀ 3 ♂♂, Montagne de la Séranne, 650 m, 14 VII 1984 (G. Delvare) (in GD); 13 ♀♀ 5 ♂♂, Fontanes, ex *M. religiosa* (G. Delvare) (in GD); Gard, 2 ♂♂, Blandas, 24 VI 1989 (G. Delvare) (in GD); 1 ♀, Saint-Laurent-de-Ceze, 21 IX 1988 (M.J. Gijswijt) (in ZMUA); 1 ♀, La-Roque-sur-Ceze, 30 VIII/12 IX 1985 (M.J. Gijswijt) (in ZMUA); 1 ♀, Saint-Michel-d'Euzet, 17 IV 1987 (M.J. Gijswijt) (in ZMUA); 1 ♀, Goussargues, 14 IX 1985 (M.J. Gijswijt) (in ZMUA); 3 ♀♀, Crespian, 9 VI 1982 (M.J. Gijswijt) (in ZMUA); Ardeche, 27 ♀♀ 3 ♂♂, Vallon-Pont-d'Arc, ex *M. religiosa*, 7 IV 1984 (H.-P. Aberlenc) (in GD); 8 ♀♀ 3 ♂♂, Labeaume, ex *M. religiosa*, X 1985 (J. Balazuc) (in GD); 2 ♀♀, St-Alban-sur-Sampzon, 30 IV 1984 (H.-P. Aberlenc) (in GD); Drôme, 1 ♂, Barret-de-Lioure, 1230 m, (J. Hamon) (in JYR); 1 ♀, Montauban, 1,000–1,100 m, 1 VI 1990 (J. Clary) (in JYR); 2 ♀♀, col d'Aubres, 5 km NE Nyons, 21 IX 1987 (M.J. Gijswijt) (in ZMUA); 2 ♀♀, Arpavon, 10 km E Nyons, 20 IX 1987 (M.J. Gijswijt) (in ZMUA); 3 ♀♀, Buis-les-Baronnies, 700–800 m, 6 VIII 1992 (G. Delvare) (in GD); 4 ♀♀, Aubres, on *Hedera*, 16/27 IX 1985 (M.J. Gijswijt) (in ZMUA); 1 ♀, Auban, 670 m, 2 V 1987 (M.J. Gijswijt) (in ZMUA); 1 ♀, Sédéron, col de l'Homme Mort, 6 IX 1990 (M.J. Gijswijt) (in ZMUA); Vaucluse, 1 ♀, Malaucene, 18 VII 1973 (M.J. Gijswijt) (in ZMUA); 1 ♀, Peypin d'Aygues, 13 V 1991 (M.J. Gijswijt) (in ZMUA); 1 ♀, Faucon, 6 VIII 1973 (M.J. Gijswijt) (in ZMUA); 1 ♀, Viens, 29 VII 1974 (M.J. Gijswijt) (in ZMUA); 1 ♀, Mont Ventoux, Combe Brune, 1,200–1,400 m, 6 IX 1986 (M.J. Gijswijt) (in ZMUA); 1 ♀, Entrechaux, 23 VIII 1988 (M.J. Gijswijt) (in ZMUA); 1 ♀, Villes-sur-Auzon, Combe Sourné, 27 IX 1990 (M.J. Gijswijt) (in ZMUA); 1 ♀, Vénasque Forest near Manosque, 1 VII 1980 (G. Delvare) (in GD); Bouches-du-Rhône, 2 ♀♀, La Ciotat, 24/28 VIII 1963 (in JYR); 1 ♀, Le Sambuc, 18 VII 1967 (J.F. Aubert) (in USNM); 1 ♀, Gimeaux, 11 VII 1967 (J.-F. Aubert) (in JYR); Alpes-de-Haute-Provence, 8 ♀♀ 1 ♂, Annot, ex *M. religiosa*, 27 VII 1975, (M.J. Gijswijt) (in ZMUA); 1 ♀, Reillanne, 21 VII 1978, on *Quercus pubescens* (M.J. Gijswijt) (in ZMUA); Var, 1 ♂, Sainte-Baume, 23 VI 1991 (M.J. Gijswijt) (in ZMUA); 1 ♀, Aups, 15 IX 1986 (M.J. Gijswijt) (in ZMUA); 2 ♀♀, Fréjus, 16/17 X 1987 (M.J. Gijswijt) (in ZMUA); 2 ♀♀, Taradeau, 6/9 X 1989 and 5 IX 1992 (M.J. Gijswijt) (in ZMUA); 1 ♀, Saint-Paul-en-Forêt, 15 VII 1995 (G. Delvare) (in GD); Alpes-Maritimes, 1 ♀ 1 ♂, col de Brouis, 19 VII 1990 (J.-Y. Rasplus) (in JYR); 1 ♂, Bouyon, 580 m, 20 V 1991 (M.J. Gijswijt) (in ZMUA). CORSICA, 1 ♀, Haut-Asco, Vecchietto forest, 790 m (J. Hamon) (in JYR); 1 ♂, PN Scandola, Elbo, 26 VI 1990 (J.-Y. Rasplus) (in JYR); 3 ♀♀ 2 ♂♂, Scandola reserve, Gargalu, 6/31 VIII 1989 (J.-Y. Rasplus) (in JYR). ITALIA: Mocerata, 1 ♀ 1 ♂, Fiastra, 1,000 m, 20 V 1993 (M.J. Gijswijt) (in ZMUA). SARDINIA, 1 ♀, Tempio, Cusseddu, 25 IX/2 X 1978 (F. Bin) (in CNCI); 1 ♂, „Oberitalien“, ex *M. religiosa*, 8 VI 1925 (in CNCI). HUNGARIA: 1 ♀, Nagykovácsi, 12 VII 1976 (M.J. Gijswijt) (in ZMUA).

REMARKS. The type of *Palmon religiosus* could not be traced in OUM and my request to the Napoli Museum for the type of *Bactyrishion bicoloratum* did not induce any reply. The monospecific genus *Cleptimorpha* was synonymized with *Podagrion* by Graham (1981) who intended to select a neotype for *Cleptimorpha binotata* but did not publish it (Graham, pers. comm.). Such a designation is important to precise the status of the genus *Cleptimorpha*. This designation is in accordance with the original data and description provided by Walker (1872b) and the type was chosen from Madeira from which *C. binotata* was described. Walker (1871) figured *Pachymerum splendidum* but the same figure was made by Haliday and had already been published in „The Entomologist“ (issue XII of October 1841) as Fig. 3 and on the back of the figure named as „Priomerus pachymerus“ (see Graham, 1987: 186–188). The name *splendidum* therefore is a junior synonym of *P. pachymerum*.

¹ Bouček, pers. comm.

DIAGNOSIS. Female 3.3 mm. Head and mesosoma with bluish reflections. Hind femur reddish, rarely dark brown. Head about 2 times as long as broad. Outline of frons in dorsal view moderately convex. OOL slightly shorter than or equal to OD ($\times 0.85-1$) (Fig. 8). Flagellum distinctly elongate (Fig. 11), combined with pedicel 1.55–1.65 times as long as width of head. F1 about as long as pedicel and 1.6–1.95 times as long as wide; F7 0.7–0.9 times as long as wide. Notauli complete. Mid lobe of mesoscutum reticulate, cells larger than those on lateral lobes (Fig. 25). Axillae with a more delicate, squamose sculpture. Axillar grooves narrow. Frenal area well distinct, nearly smooth (Fig. 29). Propodeum with carinae as an inverted Y, the lateral carinae straight and forming together an acute angle (70–80) (Fig. 31); surface rugulose-reticulate; adpetiolar area subpentagonal, postero-laterally delimited by distinct costulae; spiracle elongate, as long as its distance to hind margin of metanotum; spiracular groove fairly deep. Cubital vein of fore wing setose along the basal cell, with 11–20 hairs, basal vein with 9–14 hairs (Fig. 16). Ovipositor sheaths 1.27–1.4 times as long as body.

Male (heteromorph) 2.4–3 mm. Flagellum elongate, almost filiform (Fig. 12). Pedicel ♀ flagellum 1.75–1.82 times as long as width of head. F1 2–2.4 times and F7 1.5–1.8 times as long as wide. Frenal area fairly distinct, reticulate though more delicately so than rest of scutellum. Propodeum with carinae as an inverted Y, the lateral carinae originating on a long median branch, straight, and forming an acute angle (Fig. 36); surface reticulate to rugulose-reticulate. Hind femur reddish with penultimate tooth narrowly separated or partially fused with the terminal one (Fig. 41). Cubital vein of forewing setose, bearing 7–14 hairs along basal cell.

RECOGNITION. The elongate flagellum readily distinguishes this species from all other *Podagrion*. Other important characters are the reddish hind femur in both sexes, the complete notauli, distinct frenal area, and the straight propodeal carinae, that form an inverted Y. Large females of *P. bouceki* sp. nov. they have a more elongate flagellum and therefore might be mistaken for *P. pachymerum* because; however the ornamentation of their propodeum is quite different, with strongly curving propodeal carinae, and their hind femur is dark, with metallic reflections.

DISTRIBUTION. Europe and Mediterranean Basin: Algeria (Gr. Kabylia¹), Spain, France, Italia (Varazze, W of Genova¹), Croatia (Dalmatia¹), Hungaria, Czech Republic (Moravia¹), Slovakia¹, Poland (Tarnobrzeg, 200 km S of Warsaw¹), Bulgaria¹, Ukraine (Odessa¹), Syria (Tartous¹). The distribution is the most northern one for the genus in Europe. In France its distribution matches quite well that of its host (Bertrand 1937, Hugel 2000).

HOSTS AND BIOLOGY. *Mantis religiosa* is by far the main host of this species (Chopard 1922, Picard 1933, Sellenschlo 1984) although it was reared once from *Iris oratoria*. *Mantis religiosa* is a monovoltin species; it might be predicted that *Podagrion pachymerum* has a similar phenology because it is present in regions where *Mantis religiosa* is the only mantid species being encountered. Although this is quite possible, a few times but I did find a female of *Podagrion pachymerum* standing on an egg-case of that mantid. Laboratory observations showed that this behaviour is not exhibited by emerging females, which leave the host soon after their way out. Ovipositing females do stay on the egg-case, in which they introduce their eggs over several days (and even several weeks in laboratory cultures); it is therefore possible that a spring generation develops on egg-cases deposited the preceding autumn if females of *P. pachymerum* emerge early enough in spring to oviposit within them. Thorette (1992) quoted *P. pachymerum* as being reared from *Iris oratoria*. I did not examine the relevant specimens but based on the illustration provided (male hind femur, female ovipositor and antenna) he misidentified the species which was certainly *Podagrion gibbum*.

Podagrion splendens Spinola, 1811

(Figs 10, 13, 14, 19, 22, 40)

Podagrion splendens Spinola, 1811: 147 [no type locality].

Podagrion splendens: Nikol'skaya 1952: 110; Ferrière 1955: 209; Bouček 1976: 182; Grissell 1995: 247–248.

TYPE MATERIAL EXAMINED. Neotype ♀, here designated, labelled „Italy: Liguria Ceriale [near Albenga] 3 IX 1972 Z. Bouček leg.“ (in NHM).

ADDITIONAL MATERIAL EXAMINED. MOROCCO: 1 ♀, Moulay-Idriss, Volubilis, 17 IV 1995 (H. Tussac) (in GD); 1 ♀ 1 ♂, High Atlas, Southern slope, Tizi'n Test road, 1,700 m, 30 V 1992 (G. Delvare) (in GD). SPAIN: Almeria, 3 ♀♀, Sierra de Alhamilla, Nijar, 14 VI 1994 (G. Delvare) (in GD); 1 ♀, Sierra de Almagrera, Los Lobos, 2 V 1994 (M.J. Gijswijt) (in ZMUA); 1 ♀, Sierra de Gata, La Isleta, 16 VI 1994 (G. Delvare) (in GD); 1 ♀, Carboneras, 22 IV 1990 (M.J. Gijswijt) (in ZMUA); 1 ♂, Mojacar, 18 IV 1990 (M.J. Gijswijt) (in ZMUA); Murcia, 2 ♀♀ 2 ♂♂, Sorbas, 5 VI 1994 (G. Delvare) (in GD); Jáen, 1 ♀, National Park of Cazorla, 12 VI 1994 (G. Delvare) (in GD); Madrid, 2 ♂♂, Chinchón-Titulcia, 27 IV 1994 (J.L. Nieves) (in MNM); 1 ♀, Montarco (G. Mercet) (in MNM); 1 ♂, Navalperal (G. Mercet) (in MNM); 1 ♀, Escorial (Cabrera) (in MNM); 2 ♀♀, Manzanares el Real, 3 VII 1986 and 15 VI 1990 (M.J. Gijswijt) (in ZMUA); Alicante, 1 ♀, Jávea, 28 VIII 1992 (F. Luna) (in JYR); Girona, 1 ♀, Roses, 7 VI 1990 (H. Tussac) (in GD). FRANCE: Lot, 1 ♀, Brengues (H. Tussac) (in GD); 1 ♀, Labastide-Marnhac, Cluzel, 27 VIII 1991 (H. Tussac) (in GD); Aveyron, 1 ♀, Cantobre, 19 VII 1991 (J.-Y. Rasplus) (in JYR); Aude, 1 ♀, Gruissan, la Clape, 8 VIII 1999 (G. Delvare) (in GD); Hérault, 5 ♀♀ 1 ♂, Aumelas, ex *M. religiosa*, 8 V 1994 (J.-M. Males) (in GD); 1 ♀, Saint-Guilhem-le-Désert, 1 VI 1984 (J.-M. Males) (in GD); 1 ♂, same locality, les Lavagnes, 500 m, 18 IV 1993 (G. Delvare) (in GD); 54 ♀♀ 9 ♂♂, Cazevielle, ex *Mantis religiosa* (2 egg-cases), 6 V 1988 (G. Delvare) (in GD); 2 ♂♂, same locality and collector, ex *Iris oratoria*; 2 ♀♀, Saint-Guilhem-le-Désert (G. Delvare & J.-Y. Rasplus) (in GD); Ardèche, 22 ♀♀ 2 ♂♂, Labeaume, ex *M. religiosa*, X 1983, (J. Balazuc) (in GD); 2 ♀♀, same locality and collector, 8 VII 1984 and 1 VIII 1985 (in GD); 27 ♀♀ 1 ♂, ex *M. religiosa*, 7 IV 1984 (H.-P. Aberlenc) (in GD); 1 ♀, Labastide-de-Virac, 1 VI 1986 (H.-P. Aberlenc) (in GD); Drôme, 1 ♀, Auban, 670 m, 2 V 1987 (M.J. Gijswijt) (in ZMUA); Var, 1 ♀, Vidauban, 8 VI 1991 (M.J. Gijswijt) (in ZMUA); 1 ♀, Vidauban, bois du Rouquan, 13 VII 1995 (G. Delvare) (in GD). CORSICA, 1 ♀, PN Scandola, Elbo, 26 VI 1990 (J.-Y. Rasplus) (in JYR). SARDINIA: 4 ♀♀, Tempio, Cusseddu, 3 VII/7 VIII 1978 (F. Bin) (in CNCI). GREECE: Argolida, 15 ♀♀ 2 ♂♂, between Limnes and Agriori, ex *Empusa fasciata*, 27 VI 1996 (J.-M. Males) (in GD); Thessaloniki, 1 ♀, Kalambaka, 25 VI 1989 (M.J. Gijswijt) (in ZMUA); Lakonia, 1 ♀, Anogia, 15 km S Sparti, 1,000–1,500 m, 29 IV 1989 (M.J. Gijswijt) (in ZMUA). TURKEY: Burdur, 1 ♀, Koruglubeli, 20 km N Aglasun, 950 m, 22 VII 1981 (H. & T. v. Oorshot & H. v. d. Brink) (in ZMUA).

REMARKS. As mentioned above, until recently only one European species was recognized by some authors (Mayr 1974, Dalla Torre 1898). For a long time *P. splendens* was considered an invalid name because it was thought to be published without description (Bouček, pers. comm.). The priority was therefore given to *P. pachymerum*. Because it is now evident that more species occur, the identity of *P. splendens* becomes more important. My examination of collections housed in several national museums has shown that the species has for a long time and until now been misidentified for *P. bouceki* sp. nov. Repeated searches for the type of *P. splendens* in Spinola Collection (housed in Turin) and in other European museums has been unsuccessful (Bouček pers. comm.) (Grissell 1995). This type is therefore most probably lost. The question as to the identity of *P. splendens* is important because it is the type-species of the genus and because of the above confusion. I am resolving the problem the same way as it was for the designation of the type-species of *Elachertus* Spinola (Bouček & LaSalle 1985). It is known that the original Spinola material came from nearby Novi Ligura. The neotype was collected in the same region.

DIAGNOSIS. Female 3.4 mm. Coloration, antenna, hind femur and ovipositor as for *P. bouceki* sp. nov. Head twice as wide as long (Fig. 10). Outline of frons when seen in dorsal view only slightly convex. Frons evenly reticulate, without an area of delicate sculpture being more brightly colored. OOL somewhat shorter to very slightly longer than OD ($\times 0.7$ to 1.1). Reticulation of mid lobe of mesoscutum with cells about the same size, smaller on lateral lobes. Notauli incomplete (Fig. 22). Axillae squamose-reticulate. Axillar grooves broader anteriorly. Frenal area hardly distinct, clearly reticulate, although more delicately so than rest of scutellum. Propodeum with carinae as an

inverted V, the lateral ones forming together a strongly acute angle at base (30–60°) and strongly curving outwards posteriorly; surface rugulose-reticulate; spiracle moderately short (shorter than that of *P. bouceki* sp. nov. but longer than in *P. minus*); spiracular groove not very deep. Cubital vein of the fore wing bare along basal cell; basal vein with 9–13 hairs (Fig. 19).

Male (heteromorph) 2.5–2.8 mm. Coloration and antenna as for *P. bouceki* sp. nov. (Fig. 14). Mesonotum similar to female. Propodeal carinae branching on a longer median carina, forming together an inverted Y (median branch often obliterated or missing); propodeum surface rugulose-reticulate. Cubital vein of forewing often bare or with very few hairs, rarely with more hairs (up to 8). Hind femur sometimes dark brown or even lighter, with 4 strong teeth; penultimate tooth clearly separated from the terminal one (Fig. 40).

RECOGNITION. The species has long been misidentified for *P. bouceki* sp. nov., described above. The incomplete notauli, indistinct frenal area and usually bare cubital vein readily separate it from latter species. Other important characters are the absence of area of delicate sculpture and bright coloration on the frons and the broad axillar grooves. The male is easily distinguished from *P. bouceki* sp. nov. by the structure of its hind femur. Small females of *P. splendens* (very rare in the fields) may be misidentified for *P. minus*. However the hind femur of latter species is reddish, the OOL larger, propodeal carinae are mostly straight and the propodeum surface is reticulate.

DISTRIBUTION. Apparently the mediterranean basin; it was recorded from Russia and the Ukraina (Nikol'skaya 1952, Zerova & Seryogina 1999) but it is quite possible that part of their material was misidentified for *P. bouceki* sp. nov. Specimens examined by me came from Morocco, Spain, south of France, Italy and Greece

HOSTS. This species has mostly been reared from *Mantis religiosa* upon which it develops a winter generation (overwintering in the egg-cases). It was reared once from *Empusa fasciata* Brullé, 1832 in Greece and developed there a summer generation. I did not find any specimens from Spain and France reared from *E. pennata* although sentinels of this Empusidae were deposited near Montpellier. Finally it was reared once from *Iris oratoria*.

Species indet. A

A series of 3 ♀♀ housed in CNCI and labelled „Emerged in Lab./31 V 39/E. G. Lester“ and „ex praying mantid eggs/Europe“ undoubtedly represents an undescribed species. It is well separated from other *Podagrion* spp. by the relatively short ovipositor (only slightly longer than the body), complete notauli, distinctly reticulate axillae, dull but finely reticulate frenal area, straight propodeal carinae, forming together an acute angle (70°), very large spiracle (much longer than its distance to the hind margin of metanotum), deep spiracular groove and setose cubital vein (7–9 hairs). Nevertheless because of the inaccuracy of the locality, I do not wish to use this series to describe a new species. I could not get any information about the author of the collecting and I do not know any other specimens which agree with that series.

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The species of *Zaischnopsis* of America north of Mexico, with a checklist of described world species (Hymenoptera: Eupelmidae)

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Abstract. The species of *Zaischnopsis* Ashmead, 1904 (Eupelmidae: Eupelminae) from America north of Mexico are revised. Seven new species are described, keyed and illustrated based on females: *Z. bouceki* sp. nov., *Z. brachystylata* sp. nov., *Z. coenotea* sp. nov., *Z. erythrothorax* sp. nov., *Z. melanostylata* sp. nov., *Z. phalaros* sp. nov., and *Z. xanthocola* sp. nov. These and other described world species assigned to *Zaischnopsis* are listed in a checklist, which includes 19 new combinations.

Taxonomy, new species, new combination, key, hosts, species checklist, Chalcidoidea, Eupelmidae, *Zaischnopsis*, Nearctic region

INTRODUCTION

Gibson (1995) resurrected *Zaischnopsis* Ashmead, 1904 from synonymy with *Anastatus* Motschulsky, 1859 within a revision of the world genera of Eupelminae. He stated that about 25 species of *Zaischnopsis* were described, but most of the species were classified incorrectly in either *Anastatus* or *Brasema* Cameron, 1884. He also recorded the genus from the Nearctic region, but without listing any regional species. The purpose of this paper is to describe the fauna of *Zaischnopsis* from America north of Mexico and to provide a checklist of the described world species.

MATERIAL AND METHODS

Species assigned to *Zaischnopsis* in the checklist are based on examination of type material except where stated otherwise. Type series of the newly described species include only specimens from America north of Mexico. Females from south of the USA that appear similar to these are excluded from the type series because a revision of the Neotropical fauna is required to accurately assess variation and species limits from this much more speciose region. Terms follow Gibson (1995, 1997) for structure and Gibson (2003) for sculpture. Observations were made using a Nikon SMZ-U microscope fitted with a 10 mm ocular grid having 100 divisions, using an incandescent light source and a translucent acetate diffuser to reduce glare. All measurements except body length are relative and were taken at a magnification of 225 \times , where 10 units = .067 mm. Line drawings of antennae were traced from scanning electron micrographs and are intended only to illustrate the general shape of the antenna and relative dimensions of segments rather than exact details.

Females of regional species are readily differentiated by qualitative features. For this reason, descriptions of the new species do not include the measurements and ratios often included for chalcid species, but these are summarized in Table 1 for the holotypes.

Label data are listed verbatim for holotypes, but are standardized and condensed for other specimens because of the large number of paratypes for some species. For multiple collections from a single locality in a single year, only the first and last collection dates separated by a “–” are provided, and repetitive label data indicating collection methods and general habitats are not included. Host data that are given in parentheses associated with Hopkins numbers are derived from written records maintained at the USNM. Background information on the Hopkins U. S. System (HUSSI) can be obtained at <http://www.fs.fed.us/pnw/bmnri/hussi1.html>. Names of collec-

tors with multiple records are abbreviated as follows: BRC – Biosystematics Research Centre Hym. Team, CA – C. R. Arnaud, DS – D. R. Smith, DW – D. B. Wahl, FP – F. D. Parker, GG – G. Gordh, HG – H. N. Greenbaum, HW – H. V. Weems, Jr., JB – J. T. Becker, JDP – J. D. Pinto, JF – J. H. Frank, JH – J. L. Hanula, JL – J. S. LaSalle, JN – J. S. Noyes, JP – J. Pickering, JW – J. Wiley, K&S – J. Kloke & D. R. Smith, KK – K. V. Krombein, LM – L. Masner, LS – L. A. Stange, M&B – L. Masner & B. Bowen, MS – M. Sharkey, NS – N. M. Schiff, PR – P. J. Russell, RD – R. R. Dreisbach, RT – R. C. Thatcher, SF – S. M. Fullerton, SH – S. Heydon, SJP – S. & J. Peck, TS – T. Sims, TSM – T. Smith, VG – V. Gupta, ZP – Z. Prusak.

Paratypes are deposited in the CNCI unless indicated otherwise by one of the following acronyms for the collections on which this study was based: BMNH – The Natural History Museum, London, England; BPBM – Bernice P. Bishop Museum, Honolulu, HI, USA; CASC – California Academy of Sciences, San Francisco, CA, USA; CNCI – Canadian National Collection of Insects and Arachnids, Ottawa, ON, Canada; DEBU – Department of Environmental Biology, University of Guelph, Guelph, ON, Canada; FSCA – Florida State Collection of Arthropods, Gainesville, FL, USA; MCSN – Museo Civico di Storia Naturale “Giacomo Doria”, Genova, Italia; MNHN – Muséum national d’Histoire naturelle, Paris, France; QMBA – Queensland Museum, Brisbane, Qld., Australia; ROMT – Royal Ontario Museum, Toronto, ON, Canada; TAMU – Insect Collection, Texas A&M University, College Station, TX, USA; UCDC – Bohart Museum of Entomology, University of California, Davis, CA, USA; UCFC – University of Central Florida Collection of Arthropods, Orlando, FL, USA; UCRC – Entomology Collection, University of California, Riverside, CA, USA; USNM – U. S. National Museum of Natural History, Washington, DC, USA.

TAXONOMY

Zaischnopsis Ashmead, 1904

Ischnopsis Ashmead, 1896: 16; type species: *Ischnopsis ophthalmica* Ashmead, by monotypy and original designation; homonym of *Ischnopsis* Walsingham (1881: 236–237), discovered by Ashmead (1904b: 126).

Zaischnopsis Ashmead, 1904b: 126; replacement name for *Ischnopsis* Ashmead (1896); synonymised with *Anastatus* Motschulsky, 1859 by Bouček (1988: 550), reestablished as valid genus by Gibson (1995: 298).

Eupelmoides Masi, 1917: 160; type species: *Eupelmoides obscuratus* Masi, by monotypy; synonymy by Gibson (1995: 298).

DIAGNOSIS (regional females only). Head (Figs 8–13) with torulus below lower orbit; upper face with \cap - to \wedge -like scrobal depression, the scrobal margin straight or slightly outcurved but not distinctly sinuate above torulus, and with parascrobal region dorsally tapered and very narrow along upper inner orbit. Mandible tridentate. Propodeum with broadly \cap -shaped foramen and variably strongly transverse but sculptured plical region between low convex callar regions (Figs 24–26). Macropterous; forewing mostly infusate beyond level of parastigma except for triangular hyaline region with white setae behind marginal vein (Fig. 7) or with hyaline cross-band or symmetrical anterior and posterior hyaline spot at level encompassing apex of marginal vein and base of stigmal vein (Figs 5, 6). Mesotibia apically with oblique groove between base of tibial spur and base of tarsus, and with mesotibial apical pegs over base of tibial spur; mesotarsus ventrally with single row of pegs along both margins. Metatibia not conspicuously compressed, with dorsal margin rounded. Gaster without subbasal white band, elongate-lanceolate with Gt₁–Gt₅ emarginate (Fig. 17), and with apical margin of syntergum reflexed into short flange over base of ovipositor sheath (Figs 17, 27–31).

REMARKS. Because of often similar forewing colour patterns (Figs 5, 6), females of *Zaischnopsis* are most likely to be mistaken for those of *Anastatus*; however, both sexes of *Anastatus* have bidentate mandibles. Female *Anastatus* usually also have the scrobal margin sinuate above the torulus so that the scrobal depression is more or less bell-shaped (Gibson 1995, figs 1, 3, 5) and the propodeal plical region small, narrow and concave relative to inclined callar regions (Gibson 1995, fig. 212). A subbasal white band on the gaster usually is the most conspicuous feature to distinguish female *Anastatus* from those of *Zaischnopsis*, but some *Zaischnopsis* females from the Neotropical region have a similar gastral colour pattern. Gibson (1995) provided comprehen-

sive descriptions of both genera on a world basis. Males are not associated with any described *Zaischnopsis* species, but Gibson (1995) gave keys to differentiate females, and males he assigned to the genus, from those of other world genera.

Females that Gibson (1995) included in *Zaischnopsis* intergrade morphologically with both *Anastatus* and *Brasema* females. He provided two alternative hypotheses of character transformation that could explain the observed character-state distribution. In one scenario, *Anastatus* was hypothesized to have diversified from some species-group within *Zaischnopsis*, which itself was hypothesized to have diversified from the *Brasema schizomorpha*-group (Gibson 1995, fig. 517). In the alternate scenario, *Brasema* was hypothesized to represent a clade of species that diversified from the *Zaischnopsis simillimus*-group, and *Anastatus* a clade of species that diversified from another, unnamed species group of *Zaischnopsis* (Gibson 1995, fig. 518). *Zaischnopsis* represents a paraphyletic taxon under either hypothesis, but all three names were retained as valid because synonymy of the three names would result in a morphologically extremely diverse taxon that would be undefinable except by exclusion.

BIOLOGY. Host associations are known for three extralimital species. *Zaischnopsis locustae* was reared from the eggs of an “unidentified Locustidae” (= Orthoptera: Acrididae) in Indonesia (Java) (Girault 1919), and *Z. usingeri* was reared from eggs of an “unidentified katydid” (Orthoptera: Tettigoniidae) in Guam (Fullaway 1946). Narendran et al. (2004) also reported *Z. biharensis* was obtained from lac insect encrustations (Homoptera: Kerridae) in India, though they provided no additional information. Label data for species of *Zaischnopsis* from America north of Mexico indicate either meadow katydids (Tettigoniidae: Conocephalinae) or wood-boring Coleoptera (Buprestidae, Scolytidae) as hosts. However, many of the latter records are only associations with beetle-infested trees rather than verified rearings from specific beetle hosts.

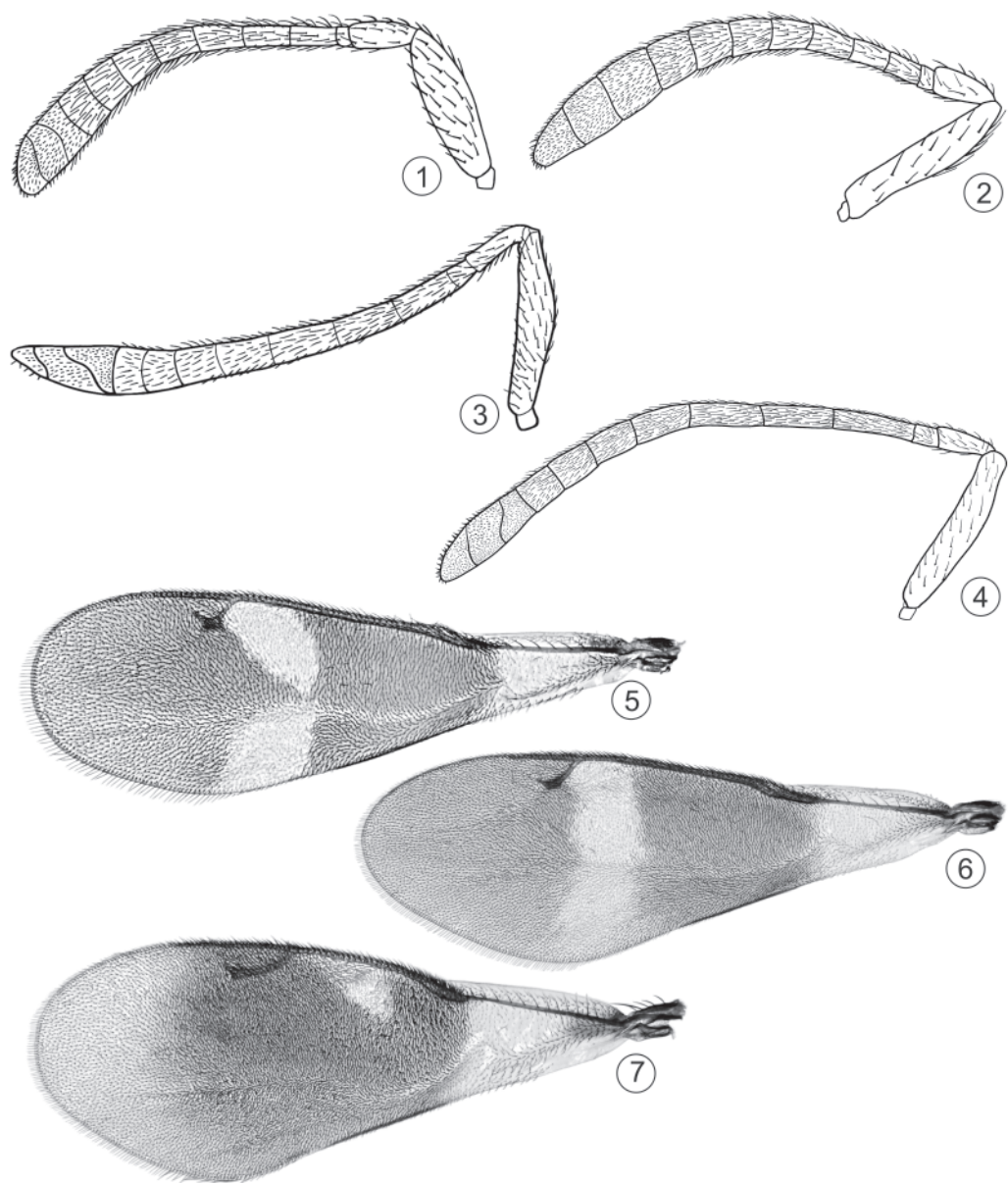
Key to females of *Zaischnopsis* in America north of Mexico

- 1 Forewing broadly infusate between about parastigma and apex of postmarginal vein except for triangular hyaline region behind length of marginal vein (Fig. 7); legs with femora through tarsi dark except for white spot dorsally within basal half of metatibia. *Z. phalaros* sp. nov.
- Forewing infusate beyond level of parastigma or gradually lightened distally, but either with symmetrical anterior and posterior hyaline spot or hyaline cross-band encompassing apex of marginal vein and base of stigmal vein (Figs 5, 6); legs or at least tarsi more extensively light coloured than described above. 2
- 2(1) Forewing with complete hyaline cross-band (Fig. 6), or if with very narrowly separated anterior and posterior hyaline spots then face, including entire scrobal depression, reticulate (Figs 8, 11); interantennal region with setae unmodified and separated (Fig. 8). 3
- Forewing with distinctly separate anterior and posterior hyaline spots (Fig. 5), or if spots narrowly connected then scrobal depression largely (Fig. 9) or entirely (Fig. 10) smooth and lustrous, and interantennal region often with dense lanceolate setae forming silvery-white reflective patch (Figs 9, 10). 5
- 3(2) Ovipositor sheath exerted for distance only about equal to length of syntergal flange; metatibia with about basal half white and apical half brown; flagellum with apical segments quadrate to slightly transverse (Fig. 1); head with occiput evenly rounded from vertex. *Z. brachystylata* sp. nov.
- Ovipositor sheath exerted for distance at least equal to one-quarter length of gaster; metatibia usually dark, sometimes orange-brown to entirely orange basally but not conspicuously bicoloured; flagellum with all segments longer than wide (Fig. 4); head with occiput comparatively flat and angled relative to vertex from level of posterior ocelli. 4
- 4(3) Mesosoma and legs excluding tarsi orange; ovipositor sheath uniformly yellowish. *Z. erythrothorax* sp. nov.
- Mesosoma dark with metallic lustre under some angles of light and legs excluding tarsi largely dark; ovipositor sheath usually with broad subapical dark band but at least with distinctly lighter tip. *Z. xanthocola* sp. nov.
- 5(2) Scutellar-axillar complex yellowish or orange basally and/or exerted portion of ovipositor sheath yellow; scrobal depression extensively reticulate dorsally (Fig. 9); metacoxa laterally setose, at least medially (Fig. 21). *Z. bouceki* sp. nov.
- Scutellar-axillar complex entirely dark and exerted portion of ovipositor sheath either almost entirely dark or distinctly banded; scrobal depression entirely smooth and lustrous (Fig. 10); metacoxa laterally with distinct mediolongitudinal bare band (Fig. 23). 6

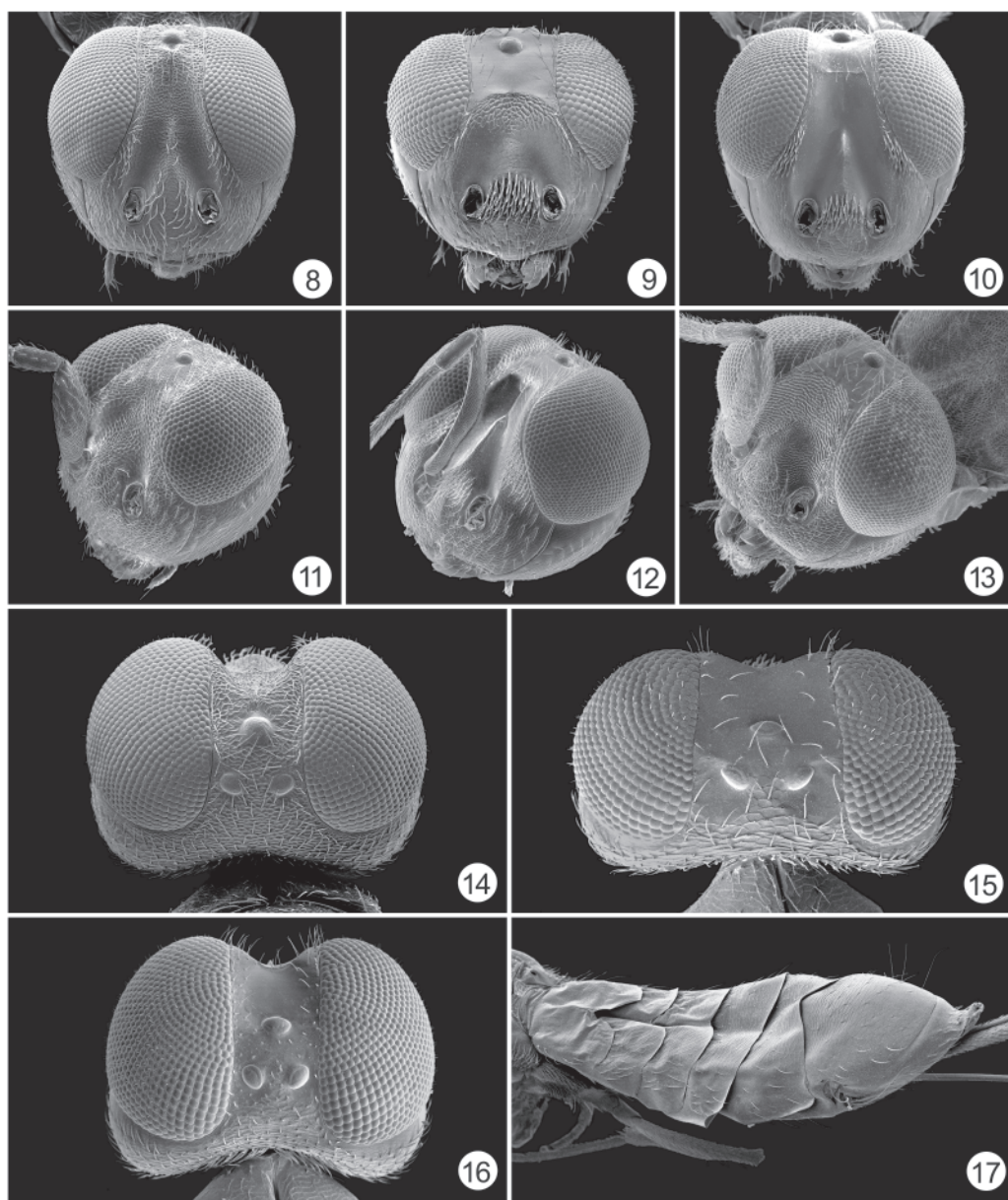
- 6(5) Ovipositor sheath dark except for tip and exerted beyond apex of syntergal flange by distance about equal to length of metatibia; syntergum in lateral view with dorsal surface comparatively flat (Fig. 27) and in dorsal view with large, extensively setose flange (Fig. 28). *Z. melanostylata* sp. nov.
- Ovipositor sheath usually whitish basally and apically, but if dark except for tip then exerted beyond apex of syntergal flange for distance equal to less than half length of metatibia; syntergum in lateral view with anterodorsal surface distinctly angled relative to flange (Fig. 29) and in dorsal view flange smaller and less conspicuously setose (Fig. 30). *Z. coenotea* sp. nov.

***Zaischnopsis bouceki* sp. nov.**
(Figs 2, 5, 9, 15, 17, 20, 21, 25, 32)

TYPE MATERIAL. Holotype female – “[USA] FL, Liberty Co., Torreya St. Pk, 8.X.1980, 8023, Masner & Bowen” (CNCI Type No. 22893) [point-mounted; entire]. Paratypes (381 females) – CANADA: **Ontario:** Ancaster, 43°15'N 80°00' W, bush/prairie, 21–28.VIII.95, B. DeJonge (1). Rondeau Prov. Pk, 1.IX.79, LM & H. Goulet (1). **Essex Co.**, Point Pelee Natl. Pk, Visitor Centre, 27.VIII–5.IX.00 (1 DEBU), 5–26.IX.00 (3 DEBU), O. Lonsdale. Toronto, E. Brule Pk, 3.VIII.98 (2 ROMT), 16.VIII.98 (2 ROMT), S. Libenson. USA: **California:** *San Bernardino Co.*, 1 mi. N. Big Bear City, Road JN09, 16.VI.88, R.H. Velton (2). **Connecticut:** *New Haven Co.*, Branford, 31.VIII.37, D.S. Riggs (1 USNM). **District of Columbia:** Washington, 3.IX.52, R. Boettcher (1 USNM). **Florida:** *Alachua Co.*, San Felasco Hammock St. Preserve, 15.VII–31.VIII.87, BRC (1). Gainesville, 30.X.83 (4), 19–30.X.84 (2), 14–26.XI.84 (3), 25.VI – 20.XI.87 (13), 1.VI–20.VIII.88 (2), DBW; 24.VI – 1–15.IX.87, JW (3); VI–VII – 21.X–18.XI.87, BRC (18); 25.X.76, P.M. Choate & R.E. Woodruff (1 FSCA). Gainesville, Doyle Conner Bldg., 19.X.71, HW & CA (1 FSCA). Gainesville, 610 N.W. 54 Ter., 30.XI.94, LS (1 FSCA). Gainesville, 9 mi. N.W., UF Hort. Unit – 5R 232, 13–22.VII.77, HG (1 FSCA). *Brevard Co.*, Malabar, Malabar Rd, 12.XII.99–2.I.00, PR & ZP (1 UCFC); 24.VII–19.VIII.00 (1 UCFC), 25.XI–10.XII.00 (1 UCFC), PR, ZP & SF. Titusville, SR 405, 14–28.IX – 16–31.X.00 (4 UCFC), 21.III–4.IV – 11–25.VII.01 (5 UCFC), PR, ZP & SF. *Miami-Dade Co.*, Everglades Nat. Pk, Royal Palm Hammock, VII.81 (3), 2.V–2.VIII.85 (1), SJP. S. Miami, Old Cutler Hammock Pk, 10.XII.86, Klimaszewski & SJP (1); S. Miami, 7900 S.W. 176 St., Old Cutler Hammock, 21.II–1.VI.86, SJP (1). *Flagler Co.*, Crescent City, 7.VI.? (1 USNM). *Highlands Co.*, Archbold Biol. Stn, 24.VIII.79, HW (1 FSCA). *Indian River Co.*, Bradenton GCREC, XII.87, VG (1). Vero Beach, 5 mi. S., 26.VII.83 (1 FSCA), 13–23.IX.83 (1 FSCA), JF. *Liberty Co.*, Torreya St. Pk, 7–8.X.80, M&B (14). *Monroe Co.*, Big Pine Key, Watsons Hammock, 3.III–29.IV.85 (1), 23.II–3.VI.86 (1), SJP. Everglades N. Pk, Royal Palm Hammock, 1.XI.84–3.III.85, SJP (3). Fleming Key, 12.VI.90, H.E. Williams & HW (1 FSCA). No Name Key, 4.III–29.IV.85 (1), 19.XI.85–26.II.86 (1), SJP. *Orange Co.*, Lk Tibet-Butler Preserve, 30.VII.96, SF (1 UCFC). Orlando, 5.VII.96 (1 UCFC), 9.V – 17.XI.97 (11 UCFC), SF; 23.III – 5.X.99, PR & SF (30 UCFC); 11.X – 14.XII.99, PR, TSM & SF (8 UCFC); 31.V – 2.VII.02, SF & TS (3 UCFC). Orlando, MacKay Tract, 26.VII.99, PR & SF (1 UCFC). Walt Disney World, 14–21.VII.98 ZP & SF (1 UCFC). *Sarasota Co.*, Myakka River St. Pk, Oak Hammock, 25.VI–3.VIII.81, SJP (1). *Seminole Co.*, 2.5 mi. N. Astor, 18.V – 16.VI.00 SF & TS (5 UCFC). Econ Wild. Area, 4.III.00, TSM (1 UCFC), 29.IV – 22.X.00, TSM, PR & SF (12 UCFC). Longwood, 15–30.IV.75 (1), 1–16.IV.75 (1), W. Mason. Lower Wekiva River St. Preserve, Burn Zone LW-5, S39 T19S R29E, 9.VI – 18.VIII.01, PR & SF (4 UCFC). Wekiwa Springs St. Pk, Burn Zone, 43/31, S22 T20S R28E, 16.IX – 18.XI.01, PR & SF (10 UCFC). *St. Johns Co.*, Fort Caroline, 13.X.80, M&B (1). **Georgia:** *Clarke Co.*, nr Athens, 15.IX.78, JH, ex. *Scolytus multistriatus* (3 USNM). 33°54'N 83°15'W, 8–15.VII.92 (7), 7–14.X.92 (1), JP. *Forsyth Co.*, Forsyth, 3–10.VII.71, F.T. Naumann (1). **Illinois:** *Champaign Co.*, U. of Ill. South Farms, 21.VIII.81, SH (1 UCDC). *Effingham Co.*, 5.5 mi. W. Mason, 7.IX.83, JDP (1). **Indiana:** *Knox Co.*, Vincennes, 16.VIII.57, D.W. Hamilton (1 USNM). **Louisiana:** *Allen Parish:* Elizabeth, IV.64, XI.66, L.S. Packard, w. *Dendroctonus frontalis* (2 USNM). Oakdale, 17.VII.25, C.K. Finger (1 USNM). *Grant Parish:* Latt Lake uplands, 48 km. N. Alexandria, 1–16.VI.98, A. Brazeal & NS (1 UCDC). *St. Tammany Parish:* Covington, 6–21.VI.98, NS & M. Devall (1UCDC). **Maryland:** *Calvert Co.*, Chesapeake Beach, 10.VIII.23, J.R. Malloch (1 USNM). Prince Frederick, 20.VIII.86 (1), 25.VIII.86 (1), MS; 7 km. S., 24.IX.87, BRC (1). Port Republic, VIII–IX.86, MS & Monroe (1). *Montgomery Co.*, Cabin John, 7.IX.03, T. Pergande (1 USNM); 7.IX.10, R.M. Fouts (1 USNM). Plummers Is., 9.IX.09, E.A. Schwarz (1 USNM); 22.VIII.14, R.C. Shannon (1 USNM); 14.IX.14, H.S. Barber (1 USNM); 1.IX – 22.X.50, KK (17 USNM). *Prince Georges Co.*, Beltsville, USDA Res. Center, 17.IX–8.X.90, G.S. Stack (2). Patuxent Wildlife Reserve, 11.IX.99, JN (3 BMNH). **Michigan:** *Clinton Co.*, 22.IX.56, RD (1 USNM). *Gladwin Co.*, 23.VIII.58, RD (1 USNM). *Midland Co.*, 17.IX.56 (3 USNM), 20.VIII.58 (1 USNM), RD. *Wayne Co.*, Belleville, 19.VII.04, lab reared from eggs of *A. planipennis* collected from Willow Park, H-P. Liu (1). **Mississippi:** *Bolivar Co.*, Dahomey Natl. Wildlife Refuge, Hwy 446 19 km. W. Boyle, 33°42'N 90°54'–56'W, 7–20.VII – 16.IX–1.XI.97 (4 UCDC), 21.VI–5.VII.98 (3 UCDC), 6–20.VII.98 (1 UCDC), NS. *Issaquena Co.*, 2.X.80, M&B (1). *Washington*



Figs 1–7. 1–4, antenna: 1, *Zaischnopsis brachystylata* sp. nov.; 2, *Z. bouceki* sp. nov.; 3, *Z. phalaros* sp. nov.; 4, *Z. xanthocola* sp. nov. 5–7, photograph of forewing: 5, *Z. bouceki* sp. nov.; 6, *Z. xanthocola* sp. nov.; 7, *Z. phalaros* sp. nov.



Figs 8–17. 8–10, head (frontal): 8, *Zaischnopsis xanthocola* sp. nov.; 9, *Z. bouceki* sp. nov.; 10, *Z. coenotea* sp. nov. 11–13, head (frontolateral): 11, *Z. brachystylata* sp. nov.; 12, *Z. melanostylata* sp. nov.; 13, *Z. phalaros* sp. nov. 14–16, head (dorsal): 14, *Z. xanthocola* sp. nov.; 15, *Z. bouceki* sp. nov.; 16, *Z. coenotea* sp. nov. 17, gaster: *Z. bouceki* sp. nov.

Co., Delta Exptl. For. nr Stoneville, 33°27'–28°N 90°54'–55°W, 26.IX–1.XI.97 (1 UCDC), 21.VI–5.VII.98 (2 UCDC), 1–15.IX.98 (2 UCDC), NS. Leroy Percy St. Pk, 8 km. W. Hollandale, 33°01'N 90°56'W, 21.VI–5.VII.98, NS (1 UCDC). **Missouri:** Boone Co., Columbia, 24.VII.66, Williams, wood infested with *Scolytus multistriatus* (1 USNM); 7.VIII.66, ex. bark dead elm (1 USNM). Greene Co., Springfield, 19.VII.83, JDP (1 UCRC). Wayne Co., Williamsville, X–XI.68 (1), 1–5.VII.69 (1), 17–29.V.70 (1), VII.87 (1), JB. **North Carolina:** Jackson Co., Whiteside Mt. nr Highlands, 160 m., VII–13.IX.87, BRC (2). Northampton Co., 7 km. S. Jackson, S. Bald Cypress Swamp, 23.IX.87, BRC (2). **Texas:** S.-E. Texas, IV–VI.63, RT, S. Pine Beetle (1 USNM). Bastrop Co., Bastrop St. Pk, 10–22.VIII.90, R. Wharton (1). Hardin Co., VIII.61, RT, Hopkins No. 46935 [associated with *Dendroctonus frontalis* and *Ips avulsus* in loblolly pine bolts] (1 USNM). **Virginia:** Clarke Co., Univ. Va. Blandy Exptl. Farm, 2 mi. S. Boyce, 8–27.VIII – 29.IX–22.X.90 (17), 21.VI–1.VII.91 (1), 14–30.IX.91 (3), 2–15.VII.94 (1), 3–21.IX.94 (2), 9–25.VII – 4–30.X.95 (4), DS. Essex Co., 1 mi. S.E. Dunnsville, 17.IX–10.X.91 (21), 11.X–5.XI.91 (4), 12–26.VII.92 (4), 17.VII–2.VIII.96 (2), DS. Fairfax Co., nr Annandale, 21.IX.81 (1 USNM), 5–7.VIII.83 (1 USNM), 23–29.VIII.87 (1), 6–12.IX.87 (1), 17–23.VII – 18–24.IX.88 (4; 1 USNM), 30.VII–5.VIII.89 (1), 20–26.VIII.89 (1), DS. Annandale Rd. Holmes Run, 23.VII.81, GG (1 UCRC). Falls Church, 21.VII.81, GG (1 UCRC). **Henrico Co.,** Richmond, 16.IX.84, SH (1 UCDC). **Louisa Co.,** 4 mi. S. Cuckoo, 3–24.IX.87 (3), 12–23.VIII – 7.X–4.XI.88 (11; 1 USNM), 23.VIII–11.IX.89 (3), 12.IX–6.X.89 (1 USNM), K&S.

DESCRIPTION OF HOLOTYPE. Length, including ovipositor sheath, 2.8 mm.

Head dark with metallic green lustre. Palpi yellow. Mandible yellowish basally and dark rufous apically. Antenna dark brown except scape yellowish-brown mesally. Scrobal depression with distinct dorsal margin separated from anterior ocellus by distance equal to about 3 ocellar diameters (Fig. 9); channel strongly reticulate; scrobes smooth and lustrous (Fig. 9). Lower face finely coriaceous. Interantennal region ventrally with dense, lanceolate, white setae forming reflective patch (Fig. 9); finely coriaceous above setae. Lower parascrobal region with scattered white setae not differentiated from other setae on face (Fig. 9). Frontovortex smooth and lustrous from scrobal depression to posterior ocelli (Fig. 9) and behind each posterior ocellus for about half length of vertex, but distinctly sculptured over posterior half of vertex and between posterior ocelli, with smooth region almost bare except for line of dark setae along inner orbit and with posterior half of vertex more extensively setose (Fig. 15); vertex evenly rounded into occiput and occiput setose and sculptured similar to posterior of vertex. Gena almost smooth and bare in triangular region formed between malar sulcus and outer orbit, but posteriorly more distinctly coriaceous-aciculate and with scattered white setae. Antenna (Table 1, Fig. 2) with scape spindle-shaped, the outer convex surface finely coriaceous and inner concave surface only extremely obscurely coriaceous, virtually smooth and lustrous; flagellum increasing distinctly in width toward clava and with apical funicular segments subquadrate.

Mesosoma brown with only very slight metallic green lustre on mesoscutum under some angles of light, except axillae and about anterior half of scutellum yellowish-orange. Legs brown with following yellowish to white: trochanters, trochantelli, fore- and middle knees and apices of tibiae, metatibia basally and apically, and all tarsi, with apical tarsal segments more distinctly yellowish. Forewing infusate beyond base of parastigma except for distinctly separated oblique-oval anterior and posterior hyaline spot (Fig. 5). Mesoscutum (Fig. 20) quite shiny and sparsely setose, with medial and lateral lobes very finely coriaceous and posteromedial concave region smooth and lustrous; with brownish hairlike setae except lateral lobe mediolongitudinally and concave region except near posterior margin bare. Scutellar-axillar complex punctate-reticulate. Acropleuron with dense band of white lanceolate setae obscuring cuticle along anterodorsal margin to level slightly beyond base of tegula (Fig. 21). Metacoxa with dense, lanceolate, white setae dorso- and ventrolaterally, but largely bare medially except subapically. Propodeum (Fig. 25) with callus broadly bare posterior to spiracle, but setose anterior to and mesal to spiracle and with dense, spatulate, white setae posterolaterally; foramen separated from anterior margin medially by distance about equal to maximum diameter of spiracle, hence reticulate plical region transverse-rectangular.

Gaster brownish-cupreous with slight metallic green lustre laterally on terga posterior to Gt₃ and with syntergal flange yellowish. Syntergum in lateral view with flange distinctly reflexed relative to anterodorsal surface; in dorsal view flange slightly transverse, the basal width about 1.4× length and sides convergent to rounded posterior margin, with setae in band of 2 or 3 rows across base. Ovipositor sheath exerted beyond syntergal flange by about 0.2× length of gaster and about 0.5× length of metatibia, the protruding portion yellowish.

VARIATION. Females vary in length from about 1.6–2.9 mm, the smaller specimens are usually brown without distinct metallic lustre. The exerted portion of the ovipositor sheath is always entirely yellow, but varies in length from about 0.4–0.55× the length of the metatibia. Rarely, females have the scutellar-axillar complex only slightly lighter in colour basally than apically, some have the metatibia entirely white ventrally, and some have the hyaline spots on the forewing virtually touching, but at least the combined apical margin of the hyaline region is strongly angulate (Fig. 5). Some females also have the metacoxa almost entirely setose laterally (Fig. 21) and sometimes yellowish-orange to whitish ventroapically along with the basal 1–3 sterna.

ETYMOLOGY. Named in honour of Zdeněk Bouček, the world's foremost chalcidologist and father of modern chalcidology.

DISTRIBUTION. Widely distributed from southern Ontario throughout eastern and midwestern North America south to states bordering the gulf of Mexico (Fig. 32). Two females apparently were also collected from a single site in southern California (Fig. 32, insert).

BIOLOGY. Likely a parasitoid of eggs of wood-boring Coleoptera. Females collected in Georgia and Missouri suggest the elm bark beetle, *Scolytus multistriatus* (Marshall, 1802), and other females collected in Louisiana and Texas suggest the southern pine beetle, *Dendroctonus frontalis* Zimmerman, 1868 and the small southern pine engraver, *Ips avulsus* (Eichhoff, 1868) (Scolytidae), as possible hosts. A single female was also obtained from an egg mass of the emerald ash borer, *Agrilus planipennis* Fairmaire, 1888 (Buprestidae) that was removed and reared along with surrounding bark from an ash tree in Michigan. This apparent host record may result from unrecognized contamination by an egg of some insect other than *A. planipennis* because it was the only individual recovered after two years of rearing field-recovered egg masses of *A. planipennis* for parasitoids.

REMARKS. The sculpture pattern of the scrobal depression (Fig. 9) is unique for females of *Z. bouceki* sp. nov. among species known from America north of Mexico. Females are usually more readily identified by their distinctly bicoloured scutellar-axillar complex in combination with entirely yellow ovipositor sheaths. Among previously described species, *Z. bouceki* sp. nov. is most similar to *Z. albomaculata*, described from St. Vincent, West Indies. Females of *Z. albomaculata* are differentiated from *Z. bouceki* sp. nov. by colour, including having the procoxa, mesocoxa and metatibia yellow, as well as by having the ovipositor sheath at least as long as the metatibia and with a broad subapical dark band, the scrobal depression much more finely sculptured dorsally, and the frontovertex narrower. In *Z. albomaculata* the distance between the eyes is about 0.25× compared to 0.33× the head width and the posterior ocellus is separated from the inner orbit by only about one-quarter its own minimum diameter compared to about the same distance as its minimum diameter in *Z. bouceki* sp. nov. (Fig. 15).

***Zaischnopsis brachystylata* sp. nov.**

(Figs 1, 11, 35)

TYPE MATERIAL. Holotype female – “[USA] LA: Chicot St. Pk., Evangeline Parish, 6–14.VII.1971, G. Heinrich” / “CNC JDR-sem 2003–024” (CNCI Type No. 22894) [point-mounted; left middle leg and antenna separated and glued to point, the antenna missing beyond Fl₅]. Paratype female – USA: **Virginia**: *Essex Co.*, 1 mi. S.E. Dunnsville, 17.VIII–6.IX.94, DS (USNM).

DESCRIPTION OF HOLOTYPE. Length, including ovipositor sheath, 2.4 mm.

Head dark with metallic green lustre except lower parascrobal region and frontovertex from apex of interantennal region to near posterior ocelli with bronze lustre. Palpi yellow. Mandible yellowish basally and dark rufous apically. Antenna brown except inner surface of scape ventrally and outer surface more extensively yellowish-brown. Scrobal depression without distinct dorsal margin, but dorsally with a few brownish setae separated from anterior ocellus by distance about equal to 2 ocellar diameters (Fig. 11). Face, including scrobal depression, reticulate (Fig. 11). Lower face, interantennal region and lower parascrobal region with scattered white lanceolate setae. Frontovertex coriaceous-reticulate between scrobal depression and posterior ocelli and with scattered dark setae (Fig. 11); vertex evenly rounded into occiput and both vertex and occiput uniformly setose and more distinctly reticulate than frontovertex. Gena finely coriaceous with scattered white setae posterior to malar sulcus (Fig. 11). Antenna (Table 1, Fig. 1) with scape spindle-shaped, the outer and inner surfaces finely coriaceous; flagellum increasing distinctly in width toward clava and with apical funicular segments quadrate to slightly transverse.

Mesosoma brown with slight metallic green lustre dorsally under some angles of light. Legs brown with following yellowish to white: trochanters, trochantelli, middle knee, apex of mesotibia, about basal half of metatibia excluding extreme base, and tarsi except for apical 1 or 2 segments. Forewing infusate beyond base of parastigma except for large, oblique, anterior and posterior hyaline spot, the spots virtually contiguous, with combined basal margin slightly curved but combined apical margin conspicuously angulate (cf. Fig. 5). Mesoscutum (cf. Fig. 18) distinctly reticulate except for posteromedial concave region, and almost uniformly setose except lateral lobe bare mediolongitudinally, the setae brownish and hair-like except slightly lanceolate and white along notaular furrows. Scutellar-axillar complex punctate-reticulate. Acropleuron with white, slightly lanceolate, separate setae not completely obscuring cuticle in band along anterodorsal margin almost to level of base of fore wing (cf. Fig. 19). Metacoxa uniformly setose laterally. Propodeum with callus setose anterior to and mesal to spiracle but otherwise bare except posterolaterally; foramen incurved virtually to anteromedial notch, hence reticulate plical region strongly transverse (cf. Fig. 24).

Gaster brown except for yellow syntergal flange. Syntergum in lateral view with flange reflexed at almost right angle to convex anterodorsal surface (cf. Fig. 29); in dorsal view flange short and transverse, about twice as wide as long with broadly rounded posterior margin, and with 2 rows of setae across base. Ovipositor sheath exerted beyond syntergal flange by distance only about equal to length of flange, the protruding portion yellowish.

VARIATION. The body regions described as brown are light brown for the holotype and dark brown for the paratype, which also has a more distinct metallic lustre on the mesonotum and on the posterior gastral terga, and the hyaline cross-band of the forewing more distinct.

ETYMOLOGY. The species epithet is derived from the Greek words *braches* (short) and *stylos* (pillar), in reference to the only slightly exerted ovipositor sheath.

DISTRIBUTION. Currently known only from Virginia and Louisiana (Fig. 35).

BIOLOGY. Unknown.

REMARKS. Females most closely resemble those of *Zaischnopsis bouceki* sp. nov. in antennal structure and colour pattern of the ovipositor sheaths, but are readily differentiated by a uniformly sculptured scrobal depression, finely but distinctly sculptured frontovertex, and uniformly coloured scutellar-axillar complex.

***Zaischnopsis coenotea* sp. nov.**

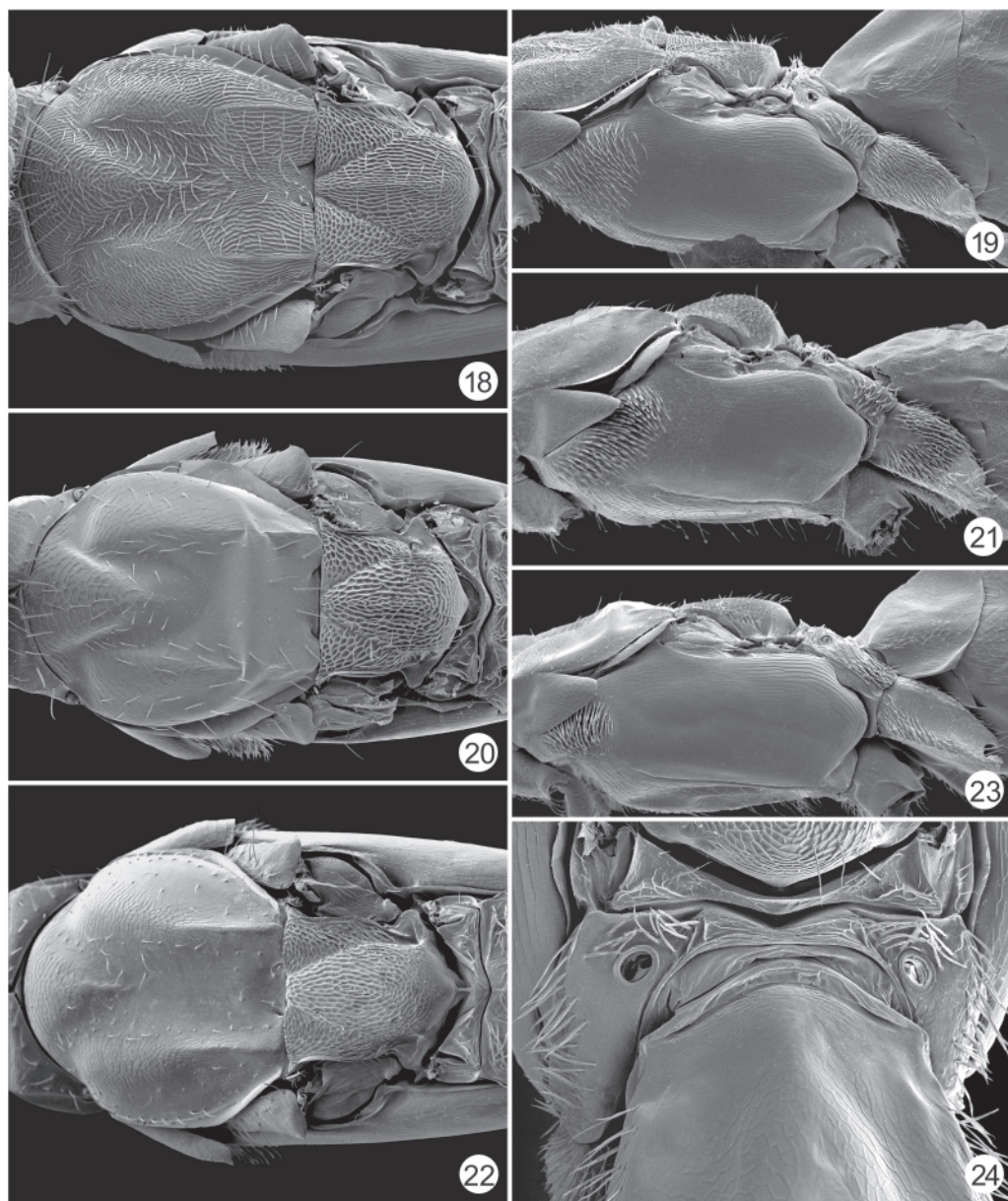
(Figs 10, 16, 22, 23, 26, 29, 30, 33)

TYPE MATERIAL. Holotype female – “USA: MO, Williamsville, 8–31.VIII.1988, J.T. Becker, MT” (CNCI Type No. 22895) [point-mounted; entire]. Paratypes (380 females) – USA: **Florida**: *Alachua Co.*, 29°44'N 82°27'W, 21–

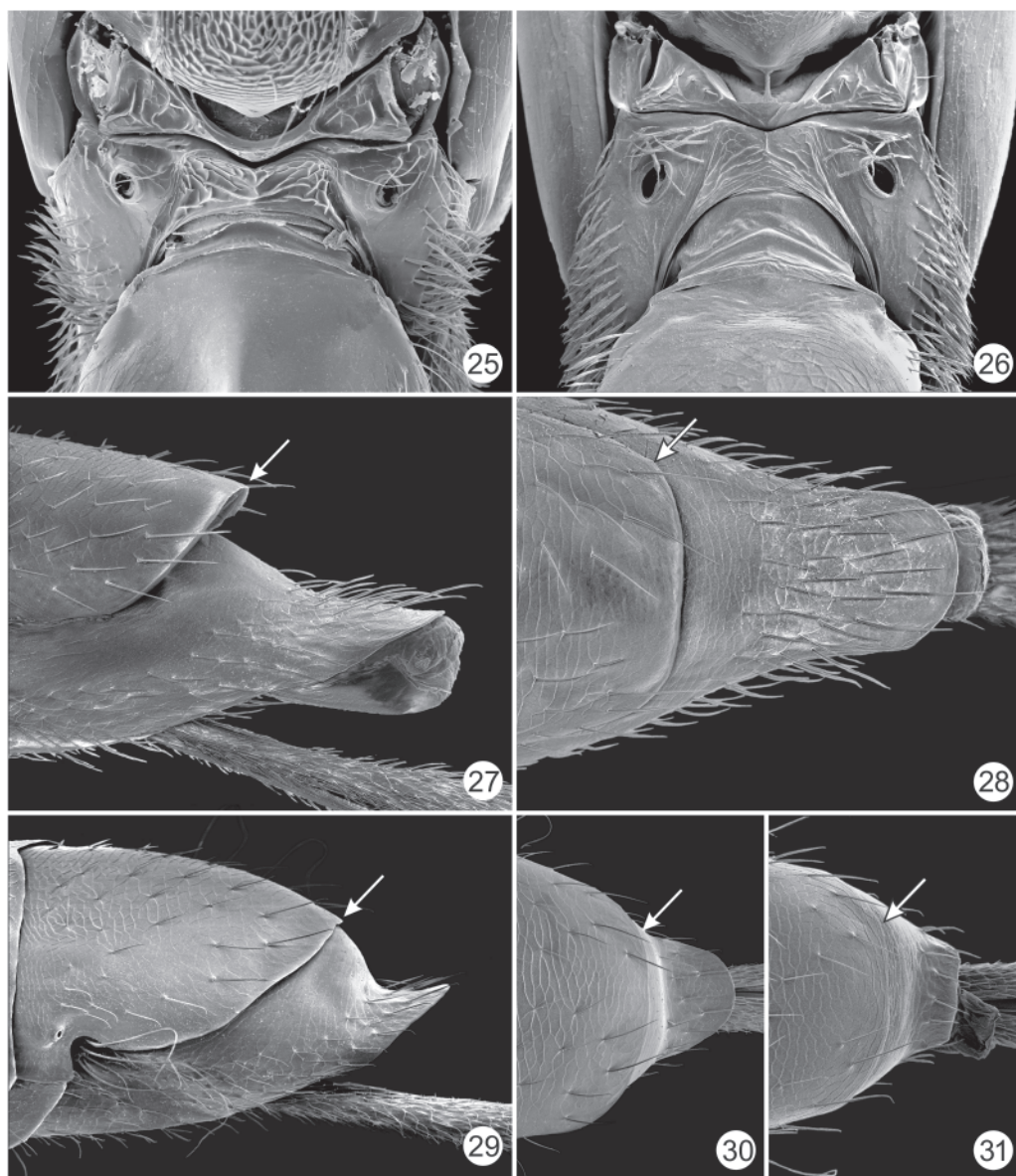
28.VII.93, JP (1). Austin Carey Forest, 16–20.VIII.76, G.B. Fairchild (1 FSCA). Gainesville, 17–24.VII.87, BRC (2); 13–18.V – 15.IX–20.X.87 (4), 14–21.V – 1.VI–20.VIII.88 (4), DBW; 10–17.IV.86, G. Gibson (3); 15–23.IV.86, JL (1); 1–31.V.87 (3), 1–23.VI.87 (1), JW; 4.V.87, LM (2). Gainesville, Beville Heights, 16–31.X.86, LS (1 FSCA). Gainesville, 9 mi. N.W., UF Hort. Unit, 5R 232, 1.IV.77, HG (1 FSCA). Pierce's Homestead, S9-T10S-R18E, 7.X.73 (1 FSCA), 9.V.74 (1 FSCA), W.H. Pierce. *Brevard Co.*, Titusville, SR 405, 15–31.VIII – 31.X–25XI.00 (6 UCFC), 4–18.IV.01 (1 UCFC), 16–30.V.01 (1 UCFC), PR, ZP & SF. *Miami-Dade Co.*, 7900 S.W. 176 St., Old Cutler Hammock, 21.II–1.VI.86, SJP (4). Chekika St. Rec. Area, Grossman Hammock, 1.XI.84–3.III.85, SJP (1). Old Cutler, 1.VII.94, S. Peck (1). *Clay Co.*, Golden Head Branch St. Pk, 30.X.94, LS & C. Porter (1 FSCA). *Jefferson Co.*, Monticello, Univ. Fl. N. Fl. Res. & Educ. Center, 30.XI.01, R. Mizell (1 UCRC). *Highlands Co.*, Lake Placid, Archbold Biol. Stn, 4–10.VIII.87, BRC (1). *Indian River Co.*, 5 mi. S. Vero Beach, 18–29.I.84, JF (1 FSCA). *Leon Co.*, Tall Timber Res. Stn, 18.VI.70, D. Harris (1 FSCA). *Levy Co.*, Manatee Springs St. Pk, 3–5.VI.78, N.F. Johnson (1). *Liberty Co.*, Torreya St. Pk, 8.X.80, M&B (3). *Manatee Co.*, Bradenton, 27.X–6.XII.85, C.M. Yoshimoto & H. Patel (1). *Marion Co.*, Lake Eaton, 10.IX–2.X.75, JW (1 FSCA). Ocala Nat. Forest, Alexander Spring, 18.IX.87, LM (1). *Monroe Co.*, Everglades Nat. Pk, 1.5 km. N.W. Royal Palm, 2.V–2.VIII.85, SJP (2). *Orange Co.*, Orlando, 11.V.99 (1 UCFC), 7.VIII.01, PR & SF (1 UCFC); 14.V.91 (1 UCFC), 27.IX.96 (1 UCFC), 18.VI.97 (1 UCFC), 21.VIII.97 (1 UCFC), SF. Orlando, MacKay Tract, 25.I – 11.X.99, PR & SF (57 UCFC); 9.X.I – 28.XII.99 (9 UCFC), 11.I.00 (7 UCFC), 25.I.00 (3 UCFC), TSM, PR & SF. Walt Disney World, 1–7.IV – 18.VIII–1.IX.98, ZP & SF (5 UCFC). Wekiwa Springs St. Pk, Burn Zone, 43/31, S22 T20S R28E, 13.IV.01, PR & SF (1 UCFC); WS-14a, S26 T20S R28E, 5.VIII.01, PR & SF (1 UCFC). *Seminole Co.*, 2.5 mi. N. Astor, 4.IV – 1.VI.00, SF & TS (14 UCFC). Econ Wild. Area, 14.VIII.00 (1 UCFC), 24.IX.00 (1 UCFC), T.Sm, PR & SF. Lower Wekiva River St. Preserve, Burn Zone, LW-5, S39 T19S R29E, 18.II – 30.IX.01, PR & SF (4 UCFC). Sanford, CFREC, VG (1). *Suwannee Co.*, Live Oak, 19.V.92, F.D. Bennett (1 FSCA). **Georgia:** *Charlton Co.*, Okefinokee Swamp, Swanee Canal Rec. Area, 4.V.85, J.W. Jones (1). *Clarke Co.*, nr Athens, 15.IX.78, JH, ex. tree infested with *Scolytus multistriatus* (4 USNM). 33°54'N 83°16'W, 23–30.IX – 14–21.X.92 (3), JP. *McIntosh Co.*, Sapelo Is., 28.IV–9.V – 15.IX–15.XI.87 (12), CNC. **Illinois:** *Effingham Co.*, 5.5 mi. W. Mason, 7.IX.93, JDP (1). **Maryland:** *Calvert Co.*, 7 km. S. Prince Frederick, 24.IX.87, BRC (1). *Prince Georges Co.*, Patuxent Wildlife Reserve, 11.IX.99, JN (1 BMNH), 8–15.80, M. Schauff (1). **Mississippi:** *Washington Co.*, Stoneville Exptl. For., 33°27'N 90°55'W, 5–26.IX.97, NS (1 UCDC). **Missouri:** *Boone Co.*, 17.IX.68 (1 UCDC), 21.VI.70 (5 UCDC), FP; Columbia, 4–5.IX.68, FP (2 USNM). *Wayne Co.*, Williamsville, X–XI.68 (2), 10.IX–5.X.69 (1), VIII – 21.X–16.XI.87 (5), 8–31.VIII – 21.X–11.XI.88 (4), JB. **North Carolina:** *Northampton Co.*, 7 km. S. Jackson, 23.IX.87, Bald Cypress Swamp, BRC (4). **Virginia:** Alexandria (independent city), 514 N. Pickett St., 8.IX.01, P.&M. Arnaud, Jr. (1 CASC). *Arlington Co.*, Arlington, 7.IX.53, KK (1 USNM). *Clarke Co.*, Univ. Va. Blandy Exptl. Farm, 2 mi. S. Boyce, 28.VIII–11.IX – 29.IX–22.X.90 (9), 14–30.IX.91 (2), 22.IX–17.X.94 (2), 12.IX–3.X.95 (4), DS. *Essex Co.*, 1 mi. S.E. Dunnsville, 17.IX–10.X.91 (39), 11.X–5XI.91 (1), 3–23.IX.93 (3), 7–30.IX – 25.X–15.XI.94 (6), 5.X–5.XI.96 (3 USNM), DS. *Fairfax Co.*, nr Annandale, 16.VIII – 10–16.IX.87 (7; 4 USNM), 27.VIII–2.IX.88 – 18–24.IX.88 (7), 10–16.IX.89 (3), 19–23.IX.89 (1), 23–29.IX.90 (1), DS. *Louisa Co.*, 4 mi. S. Cuckoo, 21.VIII–2.IX – 25.I.X–20.X.87 (26; 4 USNM), 24.VIII–14.IX – 7.X–4.XI.88 (24), 23.VIII–11.IX.89 (3), 12.IX–6.X.89 (14; 1 USNM), K&S.

DESCRIPTION OF HOLOTYPE. Length, including ovipositor sheath, 3.3 mm.

Head dark with metallic green lustre. Palpi yellow. Mandible yellowish basally and dark rufous apically. Antenna dark brown, but scape with metallic green lustre under some angles of light. Scrobal depression with distinct dorsal margin separated from anterior ocellus by distance equal to 3 ocellar diameters; channel and scrobes smooth and lustrous (Fig. 10). Lower face finely coriaceous. Interantennal region ventrally with dense, lanceolate, white setae forming reflective patch; smooth and lustrous above setae (Fig. 10). Lower parascrobal region above level of torulus with dense, lanceolate, white setae in reflective patch (Fig. 10). Frontoververtex smooth and lustrous between scrobal depression and posterior ocelli (Fig. 16), with line of dark setae along inner orbit and with a few scattered setae in ocellar triangle; vertex evenly rounded into occiput, and both vertex and occiput uniformly setose and distinctly sculptured. Gena finely coriaceous-aciculate with scattered white setae posterior to malar sulcus. Antenna (Table 1) with scape elongate spindle-shaped, the outer convex surface finely coriaceous and inner concave surface smooth and lustrous except dorsally; flagellum elongate-slender, increasing in width only slightly toward clava and with all funicular segments longer than wide (cf. Fig. 4).



Figs 18–24. 18, 19, *Zaischnopsis xanthocola* sp. nov., mesosoma: 18, dorsal; 19, lateral. 20, 21, *Z. bouceki* sp. nov., mesosoma: 20, dorsal; 21, lateral. 22, 23, *Z. coenotea* sp. nov., mesosoma: 22, dorsal; 23, lateral. 24, propodeum: *Z. xanthocola* sp. nov.



Figs 25–31. 25, 26, propodeum: 25, *Zaischnopsis bouceki* sp. nov.; 26, *Z. coenotea* sp. nov. 27, 28, syntergal flange, *Z. melanostylata* sp. nov.: 27, lateral; 28, dorsal. 29, 30, syntergal flange, *Z. coenotea* sp. nov.: 29, lateral; 30, dorsal. 31, syntergal flange (dorsal): *Z. xanthocola* sp. nov. (arrows point to posterior margin of penultimate tergum).

Mesosoma dark brown with slight metallic green lustre under some angles of light. Legs with coxae similar in colour to mesosoma, but otherwise dark brown except following white: trochantelli, fore- and middle knees, about basal half of metatibia dorsally and laterally except for extreme base, apices of all tibiae and all tarsi except apical 2 or 3 tarsal segments yellowish to brown. Forewing infusate beyond base of parastigma except for distinctly separated oblique-oval anterior and posterior hyaline spot (cf. Fig. 5). Mesoscutum (Fig. 22) quite shiny and sparsely setose, with medial and lateral lobes very finely coriaceous and posteromedial concave region smooth and lustrous; with line of brownish hair-like setae along lateral margin of lateral lobe, along either side of longitudinal ridge of lateral lobe, and with single seta posteromedially in concave region. Scutellar-axillar complex punctate-reticulate. Acropleuron with oval patch of dense, lanceolate, white setae obscuring cuticle along anterodorsal margin to level about equal with posterior margin of prepectus (Fig. 23). Metacoxa with dense, lanceolate, white setae ventrolaterally and dorsally, but broadly bare mediolongitudinally (Fig. 23). Propodeum with callus broadly bare posterior to spiracle, but setose anterior to and mesal to spiracle and with dense, spatulate, white setae posterolaterally; foramen separated from anterior margin medially by distance about equal to maximum diameter of spiracle, hence reticulate plical region transverse-rectangular (Fig. 26).

Gaster brownish-cupreous except with metallic green reflection basally on Gt_1 and laterally on terga posterior to Gt_3 . Syntergum in lateral view with flange reflexed at almost right angle to convex anterodorsal surface (Fig. 29); in dorsal view with flange slightly transverse, the basal width about $1.4\times$ length and sides convergent to rounded posterior margin, with setae in band of 2 or 3 rows across base (Fig. 30). Ovipositor sheath exerted beyond syntergal flange by about $0.25\times$ length of gaster and about $0.66\times$ length of metatibia, the protruding portion banded, with tip and region immediately beyond syntergal flange white, but dark subapically.

VARIATION. Females vary in length from about 1.6–3.4 mm, with the smallest individuals having the ovipositor sheath exerted only about $0.1\times$ the length of the gaster and about $0.25\times$ the length of the metatibia, and then sometimes entirely or almost entirely dark except for a whitish tip. Some females have an elongate hyaline region behind about the basal half of the marginal vein, with this region sometimes also having white setae. Colour pattern of the metatibia is highly variable, usually with a white stripe or a broad medial white band, but sometimes entirely dark, or almost entirely white, or dark basally and white apically. The latter colour pattern is correlated with an entirely or largely white syntergal flange, but some females with a banded metatibia also have a partly or entirely white syntergal flange.

ETYMOLOGY. The species epithet is derived from the Greek word *koinotes* (sharing in common), in reference to females of this species being diagnosed by a combination of features rather than by any unique features.

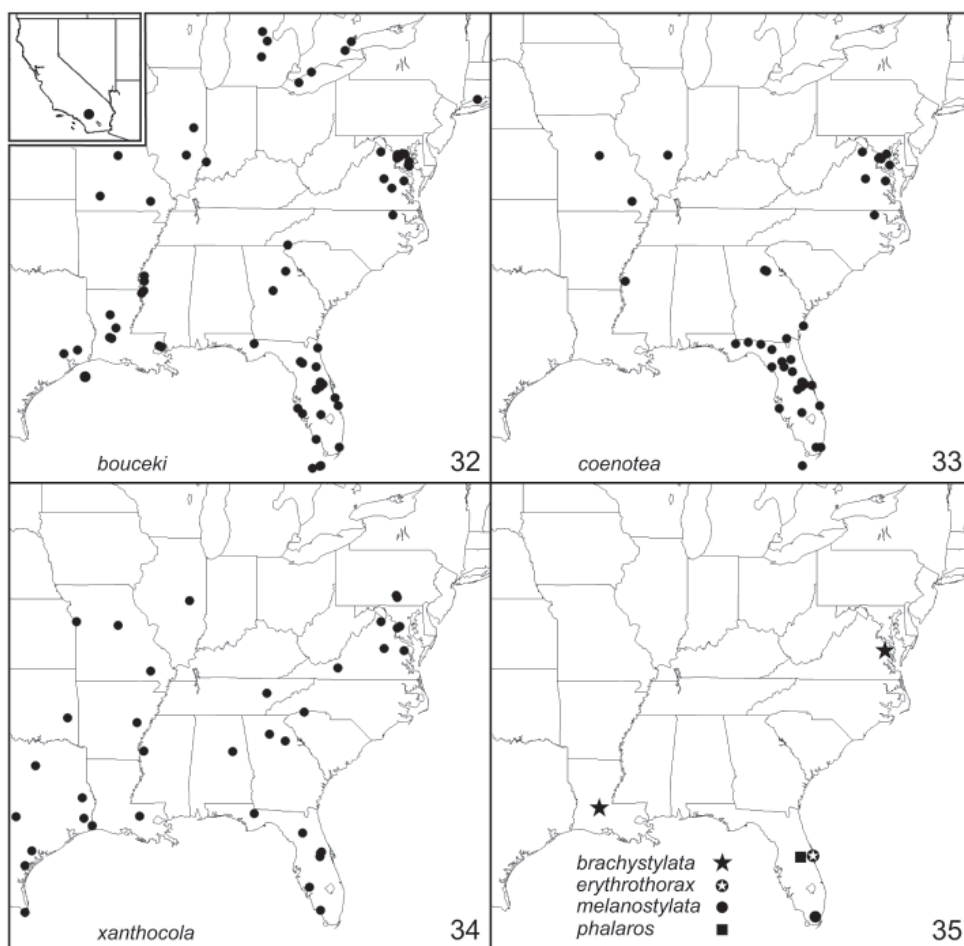
DISTRIBUTION. Throughout the eastern United States south of about 40° N and east of about 93° W (Fig. 33).

BIOLOGY. Females collected along with those of *Zaischnopsis boucke* sp. nov. from trees infested with *Scolytus multistriatus* near Athens, Georgia, represent the only known host association.

REMARKS. Females are very similar to those of *Zaischnopsis melanostylata* sp. nov., as discussed below.

Zaischnopsis erythrothorax sp. nov. (Fig. 35)

TYPE MATERIAL. Holotype female – “[USA] FL. Brevard Co., Titusville, SR 405, 15–31 August 2000, Z. Prusak, P.J. Russell, S.M. Fullerton” / “Enchanted Forest Sanct., White Trail, Xeric Oak Hammock, Malaise Trap” / “UCFC 0 083 295” (deposited in FSCA by permission of UCFC) [point-mounted; entire].



Figs 32–35. Distribution: 32, *Zaischnopsis bouceki* sp. nov.; 33, *Z. coenotea* sp. nov.; 34, *Z. xanthocola* sp. nov.; 35, *Z. brachystylata* sp. nov., *Z. erythrothorax* sp. nov., *Z. melanostylata* sp. nov., *Z. phalaros* sp. nov.

DESCRIPTION OF HOLOTYPE. Length, including ovipositor sheath, about 5 mm.

Head with rufous lustre except lower face and gena around oral cavity lighter in colour, more distinctly orange. Palpi yellowish-orange except apical segment of maxillary palpus brown. Mandible yellowish-orange basally and dark rufous apically. Antenna dark brown except scape dark orange or similar in colour to face under some angles of light. Scrobal depression with upper margin apparently extending to anterior ocellus (see Remarks). Face (cf. Fig. 8) more or less uniformly sculptured, with lower face coriaceous-reticulate, scrobal depression more reticulate-rugulose, and vertex and occiput micro-reticulate. Interantennal region and lower parascrobal region with scattered white lanceolate setae (cf. Fig. 8). Frontovortex and occiput with inconspicuous whitish to orange hair-like setae, the frontovortex flat and abruptly angled relative to comparatively flat and extensive occiput at level of anterior margin of posterior ocelli. Gena finely coriaceous-

aciculate with scattered white setae posterior to malar sulcus. Antenna (Table 1) with scape elongate spindle-shaped, the outer surface coriaceous and inner surface coriaceous-strigose; flagellum elongate-slender, increasing in width only slightly toward clava and with all funicular segments longer than wide (cf. Fig. 4).

Mesosoma orange except for black spot on pronotum anterior to mesothoracic spiracle. Legs similar in colour to mesosoma except mesotarsus and basal 2 segments of metatarsus white. Forewing infusate beyond base of parastigma except for almost straight hyaline cross-band extending almost to posterior margin (cf. Fig. 6). Mesoscutum entirely reticulate and setose except lateral lobe bare mediolongitudinally (cf. Fig. 18), the setae slightly lanceolate and white along notaular furrows and posteromedial concave region, but hair-like and white to orange depending on angle of light on medial lobe and outer surface of lateral lobe. Scutellar-axillar complex punctate-reticulate. Acropleuron anteriorly with white lanceolate setae in triangular region extending to level about equal with middle of tegula, the separate setae not completely obscuring surface of cuticle (cf. Fig. 19). Metacoxa uniformly setose laterally. Propodeum with callus broadly bare posterior to spiracle, but setose anterior to and mesal to spiracle and with dense, spatulate, white setae posterolaterally; foramen incurved virtually to anteromedial notch, hence reticulate plical region strongly transverse (cf. Fig. 24).

Gaster dark brown except with rufous lustre basally on Gt_1 and syntergal flange yellowish-hyaline. Syntergal structure partly concealed by preceding tergum, but flange apparently transverse with at least 2 rows of setae across base. Ovipositor sheath exerted beyond syntergal flange by distance similar to length of gaster and about 1.4× length of metatibia, the protruding portion uniformly yellow.

ETYMOLOGY. The species epithet is derived from the Greek words *erythros* (red) and *thorax*, in reference to the distinctive mesosomal colour pattern.

DISTRIBUTION. Known only from central Florida (Fig. 35).

BIOLOGY. Unknown.

REMARKS. Although the holotype is entire it was air-dried. Consequently, the gaster and mesoscutum are somewhat shrivelled and collapsed dorsally. Because of this the description of the gaster and relative length of the ovipositor sheath is not as exact as for other descriptions. It is also possible that the head is slightly collapsed dorsally between the eyes so that the described flat vertex, scrobal depression extending to the anterior ocellus, and abrupt angle between the vertex and occiput are artifacts of preservation. The single known female is very similar to females of *Zaischnopsis xanthocola* sp. nov. in structure, setation and sculpture, but differs conspicuously in colour.

***Zaischnopsis melanostylata* sp. nov.**

(Figs 12, 27, 28, 35)

TYPE MATERIAL. Holotype female – “[USA] FLA: Dade Co.: Chekika St. Rec. Area, 50 km SW Miami, 28.VII–15.XI.85, S&J Peck, Grossman Hammock For., malaise-FIT” / “CNCI JDR-sem 2003-025” (CNCI Type No. 22896) [point-mounted; entire but left antenna separated and glued to point]. Paratype female – same data as holotype except collected 1.XI.84–3.III.85.

DESCRIPTION OF HOLOTYPE. Length, including ovipositor sheath, about 4 mm.

Head dark with metallic green lustre. Palpi yellow. Mandible yellowish basally and dark rufous apically. Antenna dark brown, but scape with limited metallic green lustre under some angles of light. Scrobal depression with distinct dorsal margin separated from anterior ocellus by distance equal to 2 ocellar diameters; channel and scrobes smooth and lustrous (Fig. 12). Lower face strongly coriaceous to granular-coriaceous. Interantennal region with patch of dense, lanceolate, white setae ventrally; smooth and lustrous dorsal to setae (Fig. 12). Lower parascrobal region

above level of torulus with small patch of dense, lanceolate, white setae (Fig. 12). Frontovortex smooth and lustrous between scrobal depression and posterior ocelli, but with dark setae in line along inner orbit and in ocellar triangle; vertex evenly rounded into occiput, and both vertex and occiput uniformly setose and distinctly sculptured. Gena finely coriaceous-aciculate with scattered white setae posterior to malar sulcus. Antenna (Table 1) with scape elongate spindle-shaped, the outer convex surface finely coriaceous and inner concave surface smooth and lustrous except dorsally; flagellum elongate-slender, increasing in width only slightly toward clava and with all funicular segments longer than wide (*cf.* Fig. 4).

Mesosoma dark brown with metallic green lustre under some angles of light. Legs with coxae similar in colour and lustre to mesosoma, but otherwise brown except protarsus yellowish-brown and the following white: trochantelli, fore- and middle knees, large medial band on metatibia, extreme apices of all tibiae, and meso- and metatarsi except apical tarsal segments yellowish-brown. Forewing infusate beyond base of parastigma except for distinctly separated, almost circular anterior and posterior hyaline spot. Mesoscutum quite shiny with medial and lateral lobes finely coriaceous and posteromedial concave region very finely coriaceous to smooth; with brownish hair-like setae except lateral lobe mediolongitudinally and concave region except along posterior margin bare. Scutellar-axillar complex punctate-reticulate. Acropleuron with dense, lanceolate, white setae obscuring cuticle in oval patch along anterodorsal margin to level about equal with posterior margin of prepectus (*cf.* Fig. 23). Metacoxa with dense, lanceolate, white setae ventrolaterally and less conspicuous hair-like setae dorsally, but broadly bare mediolongitudinally (*cf.* Fig. 23). Propodeum with callus broadly bare posterior to spiracle, but setose anterior to and mesal to spiracle and with dense, spatulate, white setae posterolaterally; foramen incurved virtually to anteromedial notch, hence reticulate plical region strongly transverse (*cf.* Fig. 24).

Gaster brownish-cupreous except with metallic green reflection basally on Gt_1 and laterally on terga posterior to Gt_3 . Syntergum in lateral view with flange obtusely angled relative to and on only slightly lower plane than anterodorsal surface of syntergum (Fig. 27); in dorsal view flange large, about $1.5\times$ as long as wide with subparallel sides and broadly rounded posterior margin, and covered by several rows of setae (Fig. 28). Ovipositor sheath exerted beyond syntergal flange by about $0.4\times$ length of gaster and about $0.9\times$ length of metatibia, the protruding portion black except for yellowish tip.

VARIATION. The single paratype is shrivelled but does not otherwise differ substantially from the holotype.

ETYMOLOGY. The species epithet is derived from the Greek words *melanos* (dark) and *stylos* (pillar), in reference to the almost entirely black ovipositor sheath.

DISTRIBUTION. Known only from southernmost Florida (Fig. 35).

BIOLOGY. Unknown.

REMARKS. Females of *Zaischnopsis melanostylata* sp. nov. are most similar to those of *Z. coenotea* sp. nov., differing primarily in having a conspicuously larger and more setose syntergal flange (*cf.* Figs 28, 30) that is not abruptly reflexed relative to the pre-flange surface (*cf.* Figs 27, 29), and in having dark ovipositor sheaths. The mesoscutum is also more extensively setose and the face slightly more coarsely sculptured, but insufficient specimens are available to accurately assess intraspecific variation.

***Zaischnopsis phalaros* sp. nov.**

(Figs 3, 7, 13, 35)

TYPE MATERIAL. Holotype female – “[USA] UCF, MacKay Tract, FL, Orange Co., Orlando, VII-7-1999, P. Russell, S. Fullerton” / “Sawgrass Marsh, Red Maple, Malaise Trap” / “UCFC 0 041 804” / “CNCI JDR-sem

2004-047" (deposited in FSCA by permission of UCFC) [point-mounted; entire except left mesotarsus missing beyond basal segment and left flagellum detached and glued to point]. Paratype female – USA: **Florida**: *Orange Co.*, Orlando, 5.VII.96, LLP-Sand Pine, Turkey Oak, SF (deposited in CNCI by permission of UCFC).

DESCRIPTION OF HOLOTYPE. Length, including ovipositor sheath, about 2.7 mm.

Head dark with metallic green or, particularly on lower face and frontovertex, violaceous lustre under some angles of light. Palpi dark brown. Mandible yellowish-orange basally and dark rufous apically. Antenna dark brown except scape with metallic green lustre under some angles of light. Scrobal depression with distinct dorsal margin separated from anterior ocellus by about 2 ocellar diameters; channel and scrobes reticulate to transversely reticulate-strigose (Fig. 13). Lower face and interantennal region coriaceous-granular. Interantennal region and lower parascrobal region with scattered white lanceolate setae not differentiated from other setae on face (Fig. 13). Frontovertex smooth and lustrous from scrobal channel to posterior ocelli (Fig. 13), but with conspicuous dark setae; vertex angled relative to comparatively flat and extensive occiput at level of anterior margin of posterior ocelli, and both vertex and occiput coriaceous-reticulate with dark setae. Gena posterior to malar sulcus finely coriaceous-aciculate with conspicuous, white, lanceolate setae aligned at right angle to outer orbit near orbit. Antenna (Table 1, Fig. 3) with scape elongate-spindle shaped, the outer surface coriaceous and inner surface coriaceous-strigose; flagellum elongate-slender, increasing in width toward clava and with apical 2 funicular segments slightly transverse.

Mesosoma dark with violaceous lustre on pronotum and with bluish-green lustre elsewhere under some angles of light, most conspicuously so on convex part of mesoscutal lateral lobes, scutellar-axillar complex and propodeum, but with scutellar-axillar complex anteriorly and mesoscutum medially with dark band or slight cupreous lustre under some angles of light. Legs dark, similar to mesosoma, except trochantelli white and metatibia with elongate white spot dorsally within basal half. Forewing (Fig. 7) broadly infusate between base of parastigma to slightly beyond apex of postmarginal vein except for triangular hyaline region with white setae behind almost entire length of marginal vein; hyaline region with basal margin at almost right angle to marginal vein and extending about one-third width of wing, and with oblique posteroapical margin angled to near apex of marginal vein. Mesoscutum entirely reticulate (cf. Fig. 18) and setose, the setae dark and hair-like dorsally on convex parts of medial and lateral lobes but elsewhere white and lanceolate, including band of quite dense setae on outer surface of lateral lobe along mesoscutal margin, these setae similar to those on acropleuron. Scutellar-axillar complex punctate-reticulate. Acropleuron anteriorly with white lanceolate setae in triangular region extending to level about equal with middle of tegula, the separate setae not completely obscuring surface of cuticle (cf. Fig. 19). Metacoxa with dense, lanceolate, white setae ventrolaterally and dorsally, but broadly bare mediolongitudinally (cf. Fig. 23). Propodeum with callus broadly bare posterior to spiracle, but setose anterior to and mesal to spiracle and with dense, spatulate, white setae posterolaterally; foramen incurved virtually to anteromedial notch, hence reticulate plical region strongly transverse (cf. Fig. 24).

Gaster dark brown except syntergal flange yellowish-hyaline. Syntergal structure partly concealed by preceding tergum, but apparently with setae in 1 or 2 rows along base. Ovipositor sheath exerted only very slightly beyond syntergal flange, the protruding portion yellow.

VARIATION. The paratype has the ovipositor sheath exerted for a length about equal to that of the syntergal flange, but does not otherwise differ substantially from the holotype.

ETYMOLOGY. The species epithet is formed from the Greek word *phalaros* (having a white patch), in reference to the single hyaline region behind the marginal vein.

DISTRIBUTION. Known only from central Florida (Fig. 35).

BIOLOGY. Unknown.

Tab. 1. Measurements for holotypes of Nearctic *Zaischnopsis* Ashmead species (bo = *Z. bouceki* sp. nov., br = *Z. brachystylata* sp. nov., co = *Z. coenotea* sp. nov., er = *Z. erythrothorax* sp. nov., me = *Z. melanostylata* sp. nov., ph = *Z. phalaros* sp. nov., xa = *Z. xanthocola* sp. nov.)

measurement/species	bo	br	co	er	me	ph	xa
head height	63	65	67	126	96	90	80
head length	46	50	51	82	65	63	56
head width	73	71	73	128	96	115	89
distance between eyes	25	21	18	30	18	27	22
malar space	25	28	27	42	33	32	30
eye height	47	47	50	88	67	66	55
eye width	36	33	38	65	53	52	46
OOL	4	2	2	3	1	2	2
POL	6	7	5	7	6	7	8
LOL	7	8	8	12	10	9	8
scrobes to anterior ocellus	16	11	14	0	15	15	6
scape: length(width)	37(10)	35(11)	43(9)	76(13)	61(11)	60(13)	51(11)
pedicel: length(width)	12(5)	15(6)	15(6)	25(9)	20(12)	20(9)	18(6)
Fl1: length(width)	4(4)	4(4)	5(4)	9(6)	6(5)	7(7)	8(5)
Fl2: length(width)	8(5)	11(4)	13(4)	34(6)	19(5)	20(7)	20(5)
Fl3: length(width)	8(5)	11(4)	13(4)	31(7)	19(5)	22(8)	20(6)
Fl4: length(width)	9(5)	10(6)	13(5)	30(7)	19(6)	22(8)	20(7)
Fl5: length(width)	8(6)	10(8)	13(6)	24(9)	18(7)	17(10)	17(7)
Fl6: length(width)	8(7)	9(10)	11(6)	18(10)	16(8)	14(11)	14(8)
Fl7: length(width)	8(8)	8(10)	10(7)	16(10)	14(8)	11(12)	13(9)
Fl8: length(width)	8(9)	8(10)	10(7)	14(11)	13(8)	10(14)	11(9)
clava: length(width)	28(12)	25(12)	29(8)	37(15)	32(11)	39(17)	32(12)
costal cell	75	68	85	140	100	95	95
marginal vein	71	71	85	110	95	60	95
stigmal vein	16	13	13	25	20	29	19
postmarginal vein	23	26	20	40	25	45	34

REMARKS. Females of *Zaischnopsis phalaros* sp. nov. are readily distinguished from all other species in America North of Mexico by several colour, structural, sculptural and setal features as described above and given in Table 1.

Zaischnopsis xanthocola sp. nov.

(Figs 4, 6, 8, 14, 18, 19, 24, 31, 34)

TYPE MATERIAL. *Holotype* female – “USA: MO, Wayne Co., Williamsville, VI.1987, J. Becker, MT” (CNCI Type No. 22897) [point-mounted; entire but left antenna separated and glued to point]. *Paratypes* (194 females) – USA: **Alabama:** Talladega Co., Talladega, 4.VII.64, L.S. Pickord, *Dendroctonus frontalis* (1 USNM). **Arkansas:** iss[?] V.1896, 6327⁰¹, egg parasite of *Orchelimum glaberrimum* (1 USNM). **District of Columbia:** Suitland, 3.VI.54, J.G. Clarke, ex. *Conocephalus* eggs (6 USNM). **Florida:** Alachua Co., Gainesville, 15–23.IV.86 (1), 24–30.IV.86 (3), J.L. Gainesville, Payne Prairie, 5–10.IV.86, M. Sanborne (1). *Collier Co.*, Copeland, Fakahatchee Strand St. Preserve, VIII – X.87 (3), V.G. DeSoto Co., Ft. Ogden, 8–IV.52, J.R. Vockeroth (1). *Liberty Co.*, Torreya St. Pk, 15.VI.74, HW & CA (1 FSCA). *Orange Co.*, Orlando, 7.IX.99, PR & SF (1 UCFC). *Seminole Co.*, 2.5 mi. N. Astor Farms, 29.III – 19.VII.00 (75 UCFC), SF & TS. Sanford, CFREC, 4.VIII.87 (1), 18.VIII.87 (2), V.G. **Georgia:** Clarke Co., 33°54'N 83°16'W, 8–15.VII.92 (1), 7–14.X.92 (2), J.P. Forsyth Co., Forsyth, 8–22.IX.70, F.T. Naumann (1). **Illinois:** Champaign Co., 21.VIII.81, SH (1 UCDC). **Louisiana:** East Baton Parish, Baton Rouge, 21.VIII.00, L.S.U. Expt 229, Sub. No. 26 (1 USNM). **Mississippi:** Washington Co., Stoneville Exptl. For., 33°27'N 90°55'W, 25.V–7.VI – 1.XI.97 (3 UCDC), 20.VI–3.VIII.98 (1 UCDC), 1–14.VIII.98 (1 UCDC), NS. **Missouri:** Boone Co., Columbia, 8.IX.67 (1 USNM), 1–15.IV.68 (1 USNM), 21.VI.70

(2 UCDC), FP. *Jackson Co.*, Kansas City, Willow Crk, I-4 43 & Wornall Rd, 11.VI.77, HG (1 FSCA). *Wayne Co.*, Williamsville, VI.70 (1), VIII.87 (6), 10-26.IX.87 (5), 20.IX-20.X.88 (1), JB. **North Carolina**: *Polk Co.*, Tyron, Hopkins U.S. 3606d [from Ash infested with *Hylesinus aculeatus*, tree cut 5.VIII.04, two parasites emerged 20.VII after all *Hylesinus* emerged] (1 USNM). **Oklahoma**: *Latimer Co.*, VII.87 (1 FSCA), IX.88 (1 FSCA), VII.89 (2 FSCA), K. Stephan; Red Oak env., IX.94, K. Stephan (2). **Pennsylvania**: *Cumberland Co.*, Carlise, 2.VI.31, E.J. Udine, reared from *Orchelimum* eggs in *Dacus carota* (7 USNM). Mount Holly Springs, 28.X.30-21.I.31, E.J. Udine, reared from *Orchelimum* eggs in *Dacus carota* (3 USNM). **Tennessee**: *Roane Co.*, AEC area, Oak Ridge, 27.VI.57, H.F. Howden (1). **Texas**: *Cameron Co.*, Southpoint Nursery, 1 mi. S. Southmost Ranch, 5-6.VII.82, G. Gibson (1). *Dallas Co.*, Dallas, 9-16, W120, Hunter No. 1447 (2 USNM, unidentified egg glued to each point). *Hardin Co.*, 26.VI.1963, RT, loblolly pine, reared with *Dendroctonus frontalis* Zimm. (1 USNM). *Orange Co.*, Orange, 10 mi. W., 8.X.51, A. B. Gurney (1 USNM). *San Augustine Co.*, Broadus, 14.VII.65, Hopkins 50648 [pine infested with southern pine beetle] (1 USNM). *San Patricio Co.*, Welder Wildlife Refuge, Pollito Lk, 29.VI.84, J.C. Schaffner (1). *Travis Co.*, vic. Cypress Creek, 30°25'58" 97°52'01", 28-29.VII.94, M. Quinn, E. Riley & R. Wharton (1 TAMU). *Victoria Co.*, Victoria, VI.21, J.D. Mitchell (1 USNM). **Virginia**: *Clarke Co.*, Univ. Va. Blandy Exptl. Farm, 2 mi. S. Boyce, 28.VIII-IX.90 (1), 12-28.IX.90 (2), 9-25.VIII.95 (1), DS. *Essex Co.*, 3-23.IX.93 (1), 7-30.IX.94 (1), DS. *Fairfax Co.*, nr Annandale, 19-23.IX.89 (1), 22-29.IX.90 (1), 7-13.X.90 (1), DS. *Louisa Co.*, 4 mi. S. Cuckoo, 7, 14.VII.85 (2 USNM), 23.VI - 30.VIII-20.IX.86 (4), 3-24.IX.87 (6; 1 USNM), 21.IX-13.X.87 (3), 24.VIII-14.IX - 7.X-4.XI.88 (7), 23.VIII-11.IX.89 (6), 12.IX-6.X.89 (2), K&S. *Montgomery Co.*, 18.IX.62, Pienkowski (1 USNM).

DESCRIPTION OF HOLOTYPE. Length, including ovipositor sheath, about 3.75 mm.

Head bright metallic green with slight cupreous lustre dorsally. Palpi yellow. Mandible yellowish basally and dark rufous apically. Antenna dark brown. Scrobal depression without distinct dorsal margin, but dorsally with a few brownish setae separated from anterior ocellus by distance equal to about 1 ocellar diameter. Face (Fig. 8) more or less uniformly sculptured, with lower face coriaceous-reticulate, scrobal depression more reticulate-rugulose, and frontovertex and occiput micro-reticulate. Interantennal region and lower parascrobal region with scattered white lanceolate setae (Fig. 8). Frontovertex and occiput with comparatively inconspicuous brownish hair-like setae, the vertex angled relative to comparatively flat and extensive occiput at level of anterior margin of posterior ocelli. Gena finely coriaceous-aciculate with scattered white setae posterior to malar sulcus. Antenna (Table 1, Fig. 4) with scape elongate spindle-shaped, the outer and inner surfaces finely coriaceous; flagellum elongate-slender, increasing in width only slightly toward clava and with all funicular segments longer than wide.

Mesosoma largely dark brown but with metallic green lustre under some angles of light on pronotum, mesoscutum and setose region of acropleuron. Foreleg dark brown except trochantellus, knee and often 1 or more tarsal segments whitish; middle leg primarily yellowish beyond coxa but with femur posteroapically and tibia posterobasally brown, and basal 3 tarsal segments white; hind leg dark brown except trochantellus and basal 2 tarsal segments yellowish to white. Forewing infusate beyond base of parastigma except for almost straight hyaline cross-band extending almost to posterior margin (Fig. 6). Mesoscutum entirely reticulate to more longitudinally strigose posteriorly, with lateral lobe bare mediolongitudinally but with slightly lanceolate white setae along notaular furrows and medially through posterior concave region, and with brownish hair-like setae elsewhere (Fig. 18). Scutellar-axillar complex punctate-reticulate. Acropleuron anteriorly with white, slightly lanceolate, setae in triangular region extending to level about equal with middle of tegula, the separate setae not completely obscuring surface of cuticle (Fig. 19). Metacoxa uniformly setose laterally. Propodeum with callus broadly bare posterior to spiracle, but setose anterior to and mesal to spiracle and with dense, spatulate, white setae posterolaterally; foramen incurved almost to anteromedial notch, hence reticulate plical region strongly transverse (Fig. 24).

Gaster dark brown with cupreous lustre except syntergal flange yellow and with metallic green reflection basally on Gt₁ and laterally on terga posterior to Gt₃. Syntergum in lateral view with

flange abruptly reflexed relative to anterodorsal surface (cf. Fig. 29); in dorsal view flange short and transverse, about $3\times$ as wide as long with subtruncate posterior margin and with single row of sparse setae across base (Fig. 31). Ovipositor sheath exerted beyond syntergal flange by about $0.35\times$ length of the gaster and about $0.9\times$ length of metatibia, the protruding portion banded by broad subapical dark region basal to yellowish tip.

VARIATION. Females vary in length from about 3.0–6.5 mm, with the exerted portion of the ovipositor sheath about $0.25\text{--}0.7\times$ the gaster length and about $0.5\text{--}1.6\times$ the length of the metatibia. Some individuals also have the posterior ocellus contiguous with the inner orbit and then also have a somewhat narrower interocular distance. The ovipositor sheaths are not always conspicuously banded, sometimes being yellowish basally and gradually darkened apically, but the tip is always yellow. Furthermore, some females lack bright metallic green lustre, having the head and mesosoma brown with a cupreous or bronze lustre. Some females have up to about the basal half of the metatibia orange-brown or very rarely extensively yellowish-orange, but not distinctly white basally. The middle legs are conspicuously lighter in colour than the front and hind legs except for a few specimens from Virginia. These females have the mesofemur and mesotibia dark (knee and tibia apically lighter coloured), similar in appearance to the other legs, as well as having the apical 4 tarsomeres of the metatarsus brown in distinct contrast to a white basitarsomere. These same females have a comparatively short ovipositor sheath, only about half the length of the metatibia.

ETYMOLOGY. The species epithet is derived from the Greek words *xanthos* (yellow) and *kolon* (leg), in reference to the primarily light coloured middle leg.

DISTRIBUTION. Widely distributed throughout eastern North America south of about 40° N and east of about 98° W (Fig. 34).

BIOLOGY. Females from Arkansas, District of Columbia and Pennsylvania were reared from meadow katydid (Orthoptera: Tettigoniidae) eggs, including those of the red-headed meadow katydid, *Orchelimum erythrocephalum* Davis, 1905 (= *O. glaberrimum* Burmeister, 1838), *Orchelimum* sp. in wild carrot, *Dacus carota* L. (Umbelliferae), and *Conocephalus* sp. Females from North Carolina were reared from the eastern ash bark beetle, *Hylesinus aculeatus* (Say, 1824), whereas females from Alabama and Texas were reared from trees infested with the southern pine beetle, *Dendroctonus frontalis* (Coleoptera: Scolytidae).

REMARKS. Females of this species are very similar to *Zaischnopsis unifasciata*, described from Brazil. The unique, air-dried holotype of *Z. unifasciata* has the wings folded one above the other on top of the gaster and because the specimen is strongly contorted, with the gaster and head reflexed dorsally, these obscure a direct dorsal view of the mesosoma. The syntergal flange is also covered by the preceding tergum, the right antenna is missing beyond the second flagellomere, some flagellomeres of the left antenna are collapsed, and the setae anteriorly on the acropleuron appear to be largely abraded on the right side compared with the left side. Consequently, not all features needed to confidently place the name are visible. I have, however, seen better preserved females from Mexico, Ecuador and Peru (CNCI) that are similar to the holotype of *Z. unifasciata* and that are more directly comparable to specimens from America north of Mexico. All the females from south of the United States have the femora and tibiae of all legs similarly dark. This colour pattern differs from females of *Z. xanthocola* sp. nov. throughout its range, including from subtropical Florida, except for the few females from Virginia (CNCI) discussed above. Because of their comparatively short ovipositor sheaths, these aberrant females with dark middle legs differ from those from the Neotropical region with a similar colour pattern. These females have the ovipositor sheath at least as long as the metatibia, similar to many *Z. xanthocola* sp. nov. females with the more typical light coloured middle legs. Females of *Z. xanthocola* sp. nov. and *Z. unifasciata*, and possibly *Z. erythrorhox* sp. nov., share a distinctive structure and setal pattern of the syntergal

flange. The flange is transverse with a subtruncate posterior margin and has only a single transverse row of comparatively sparse setae (Fig. 31). I have seen females from Costa Rica (CNCI) that are very similar in all respects to *Z. unifasciata* except that the forewings have an anterior and posterior hyaline spot rather than a cross band, and the syntergal flange has a broadly rounded posterior margin and is quite densely setose. Another female from Costa Rica (CNCI) is even more similar because of a hyaline cross band on the forewing, but it has a broadly rounded syntergal flange and unusually long ovipositor sheaths. The species status of this specimen is uncertain. It is possible that a comprehensive revision of Neotropical *Zaischnopsis* that includes specimens more representative of the entire region will eventually show *Z. xanthocola* sp. nov. to be a synonym of *Z. unifasciata*. However, I prefer to describe the females from America north of Mexico as a new species because of the host information attached to the Nearctic specimens and because accurate assessment of species limits and their distribution in the Neotropical region is not presently possible.

Checklist of world *Zaischnopsis*

INCLUDED SPECIES

***Zaischnopsis aenea* (Yoshimoto et Ishii, 1965) comb. nov.**

Eupelmus aeneus Yoshimoto et Ishii, 1965: 146–147; holotype female, by original designation (BPBM; type no. 3576); type locality: S. Mariana Is.: Guam, Pt. Taguan.

***Zaischnopsis albispina* (Cameron, 1884) comb. nov.**

Eupelmus albispina Cameron, 1884: 120; holotype female, by original designation (BMNH; type no. 5.993); type locality: Panama: Bugaba.

***Zaischnopsis albomaculata* (Ashmead, 1900) comb. nov.**

Eupelmus albomaculatus Ashmead, 1900: 259; syntypes, female (BMNH); type locality: St. Vincent [West Indies].

***Zaischnopsis biharensis* (Narendran, 2004) comb. nov.**

Anastatus biharensis Narendran, 2004: 16–18; holotype female, by original designation (Department of Zoology, University of Calicut; not examined, transfer made based on original description and illustrations); type locality: India: Bihar, Ranchi.

***Zaischnopsis bouceki* sp. nov.**

***Zaischnopsis brachystylata* sp. nov.**

***Zaischnopsis coenotea* sp. nov.**

***Zaischnopsis cooki* (Girault, 1919) comb. nov.**

Anastatus cooki Girault, 1919: 59; syntypes, female [one female labelled as lectotype of *Anastatus cooki* Girault by Z. Bouček in BMNH with label “Singapore, coll. Baker”; another female lacking head in QMBA with labels “*Anastatus cooki* Gir. female type” and “Singapore, coll. Baker”]; type locality: Malaysia: Singapore.

Eupelmus cooki: Girault 1928: 449; change of combination.

***Zaischnopsis erythrothorax* sp. nov.**

***Zaischnopsis fascipennis* (Walker, 1862) comb. nov.**

Calosoter bifasciatus Walker, 1862: 391; holotype female [label on holotype “female *Anastatus walkeri* nom. nov. (*bifasciatus* W. nec Geof.) det. Z. Bouček, 1978”], by monotypy (BMNH; type no. 5.1030); type locality: Malaysia: Sarawak.

Eupelmus fascipennis: Walker 1872: 84; change of combination and replacement name [through inference, *Calosoter bifasciatus* was transferred to *Eupelmus* by Walker, who provided the new name *E. fascipennis* for *E. bifasciatus* (Walker), then preoccupied by *Eupelmus bifasciatus* Geoffroy, 1785].

***Zaischnopsis geniculata* (Cameron, 1884) comb. nov.**

Eupelmus geniculatus Cameron, 1884: 119–120; holotype female, by monotypy (BMNH; type no. 5.992); type locality: Panama: Bugaba.

***Zaischnopsis hookeri* (Girault, 1915) comb. nov.**

Eupelmus hookeri Girault, 1915: 11–12; holotype female [head and hind legs on slide], by monotypy (QMBA; type no. Hy.2852); type locality: Australia: Queensland, Babinda.

Anastatus hookeri: Bouček 1988: 552; change of combination.

***Zaischnopsis intonsiocula* (Girault, 1934) comb. nov.**

Eupelmus intonsioculus Girault, 1934: 1; holotype female, by monotypy (QMBA; type no. T.4288); type locality: Australia: [Queensland], Kuranda.

Anastatus intonsioculus: Bouček 1988: 552. Change of combination.

***Zaischnopsis ivondroi* (Risbec, 1952) comb. nov.**

Macreupelmus ivondroi Risbec, 1952: 127–128; holotype female, by monotypy (MNHN); type locality: Madagascar: Ivondro.

***Zaischnopsis ivondroi* (Risbec, 1952)**

Metacalosoter ivondroi Risbec, 1952: 146–147; holotype female, by monotypy (MNHN); type locality: Madagascar: Ivondro.

Anastatus ivondroi: Bouček 1976: 350; change of combination.

Zaischnopsis ivondroi: Gibson 1989: 64; change of combination [homonym of *Z. ivondroi* Risbec, 1952: 127; a new name is not provided at this time pending revision of the Afrotropical species].

***Zaischnopsis kraussi* (Yoshimoto et Ishii, 1965) comb. nov.**

Anastatus kraussi Yoshimoto et Ishii, 1965: 155–156; holotype female, by original designation (USNM; type no. 67526); type locality: S. Mariana Is.: Guam, Talofofo.

***Zaischnopsis locustae* (Girault, 1919) comb. nov.**

Anastatus locustae Girault, 1919: 58–59; syntypes, female (QMBA) [this species was not treated by Dahms (1984) but there are 5 variably complete females glued to one card triangle; the pin bears a label in Girault's writing with "*Anastatus locustae* Gir. female type"]; type locality: Indonesia: Eastern Java, Ngredjo-Malang; reared from locustid eggs in twigs of *Coffea robusta*.

***Zaischnopsis longiventris* (Cameron, 1884)**

Lutnes longiventris Cameron, 1884: 127; holotype female, by monotypy (BMNH; type no. 5.960); type locality: Panama: Bugaba.

Zaischnopsis longiventris: Gibson 1995: 219; change of combination.

***Zaischnopsis magniscapa* (Girault, 1919) comb. nov.**

Anastatus magniscapus Girault, 1919: 59; syntypes, female (QMBA) [this species was not treated by Dahms (1984) but there are 5 variably complete females glued to one card triangle; the pin bears a label in Girault's writing with "*Anastatus magniscapus* Gir. female type"]; type locality: Indonesia: Java.

***Zaischnopsis malgacina* (Risbec, 1952) comb. nov.**

Macreupelmus malgacinus Risbec, 1952: 125; holotype female, by monotypy (MNHN); type locality: Madagascar: Bekily.

***Zaischnopsis melanoptera* (Risbec, 1952)**

Calosoter melanoptera Risbec, 1952: 135–137; holotype female, by monotypy (MNHN); type locality: Madagascar: Ivondro.

Polymoria melanoptera: Hedqvist 1970: 441; change of combination.

Zaischnopsis melanoptera: Gibson, 1989: 64; change of combination.

***Zaischnopsis melanostylata* sp. nov.**

***Zaischnopsis motschulskini* (Girault, 1915) comb. nov.**

Eupelmus motschulskini Girault, 1915: 9; holotype female [head and hind leg on slide], by monotypy (QMBA; type no. Hy.2846); type locality: Australia: [Queensland], Torres Strait, Thursday Island.

Anastatus motschulskini: Bouček 1988: 552; change of combination.

***Zaischnopsis obscurata* (Masi, 1917)**

Eupelmoides obscuratus Masi, 1917: 160–162; syntypes, female [described from 6 females: 2 females (5.1009a, 5.1009b) in BMNH and 3 females (no. 17, 40, 47) in MCSN examined]; type locality: Seychelles Islands: Silhouette I.; Mahé.

Anastatus obscuratus: Bouček 1988: 550; change of combination [by inference through synonymy of type species of *Eupelmoides* with *Anastatus*].

Zaischnopsis obscuratus: Gibson 1995: 298, 319; change of combination [by inference through synonymy of type species of *Eupelmoides* with *Zaischnopsis*].

***Zaischnopsis octavia* (Girault, 1939) comb. nov.**

Eupelmus octavia Girault, 1939: 148–149; holotype female, by monotypy (QMBA; type no. T.4344); type locality: Australia: [Queensland], Dunk Is.

Anastatus octavia: Bouček 1988: 552; change of combination.

***Zaischnopsis ophthalmica* (Ashmead, 1896)**

Ichnopsis ophthalmica Ashmead, 1896: 16; holotype female, by monotypy (BMNH; type no. 5.967); type locality: St. Vincent [West Indies].

Zaischnopsis ophthalmica: Ashmead 1904b: 126; change of combination.

***Zaischnopsis phalaros* sp. nov.**

***Zaischnopsis simillima* (Ashmead, 1904)**

Eupelmus simillimus Ashmead, 1904a: 490; holotype female, by monotypy (USNM; type no. 60536); type locality: Brazil: Chapada.

Zaischnopsis simillimus: Gibson 1995: 301; change of combination.

***Zaischnopsis thoracica* (Ashmead, 1904)**

Ischnopsis thoracica Ashmead, 1904a: 487; holotype female, by monotypy (USNM; type no. 60525); type locality: Brazil: Santarem.

Zaischnopsis thoracica: De Santis 1980: 205; change of combination.

***Zaischnopsis tubatia* (Walker, 1852) comb. nov.**

Eupelmus tubatius Walker, 1852: 41; holotype female, by monotypy (BMNH; type no. 5.975); type locality: China: Hong Kong.

***Zaischnopsis unifasciata* (Ashmead, 1904) comb. nov.**

Eupelmus unifasciatus Ashmead, 1904a: 490; holotype female, by monotypy (USNM; type no. 60535); type locality: Brazil: Chapada.

***Zaischnopsis usingeri* Fullaway, 1946**

Zaischnopsis usingeri Fullaway, 1946: 202–203; holotype female, by original designation (USNM; type no. 58391) [holotype female missing from pin but USNM and BPBM each with single paratype]; type locality: Guam: Piti; reared from eggs of an unidentified katydid.

***Zaischnopsis viridiceps* (Yoshimoto et Ishii, 1965) comb. nov.**

Eupelmus viridiceps Yoshimoto et Ishii, 1965: 152–153; holotype female, by original designation (USNM; type no. 67524); type locality: Caroline Is.: Ponape I., Nahpali I.

***Zaischnopsis xanthocola* sp. nov.**

A c k n o w l e d g e m e n t s

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A new species of *Torymoides* (Hymenoptera: Torymidae), with an overview of Nearctic species

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Abstract. *Torymoides boucekianus* sp. nov., is described, illustrated, and compared with the two previously described Nearctic species of the genus. The new species is tentatively associated with gall-forming Cecidomyiidae (Diptera). Although widespread across the southern United States, its habits remain essentially unknown. A key is given to separate the three known Nearctic species. New state records from Massachusetts and Maryland are presented for *Torymoides smithi* (Schread, 1937) and from Maryland and Georgia for *T. sulcius* (Walker, 1839).

Taxonomy, new species, distribution, Hymenoptera, Chalcidoidea, Torymidae, *Torymoides*, Nearctic region

INTRODUCTION

The cosmopolitan genus *Torymoides* Walker, 1839 contains 49 described species of which only seven are known from the New World (Grissell 1995, Noyes 2003). Of these, two occur in the Nearctic: *Torymoides smithi*, reported from Connecticut, and *T. sulcius*, a widespread Neotropical species whose northernmost range includes Florida and Texas. The Neotropical species of *Torymoides* (except *T. sulcius*) were all described from Argentina by Kieffer & Jorgensen (1910) as *Lochites* Förster, 1856 but were transferred to *Torymoides* by Grissell (1995). Since their descriptions the type material of all of Kieffer and Jorgensen's material has been lost, nothing has been written about them, and none of the species have been recognized. These species are *T. asphondyliarum*, *T. erythroma*, *T. festiva*, *T. swaedicola*, and *T. testacea*.

In general the biology of *Torymoides* species is poorly known. Of 49 species, 13 have been reared from gall-forming Cecidomyiidae, two from Tephritidae, and four from unknown gall-forming insects (Grissell 1995). One species, reared from seeds of Pinaceae, was thought to be parasitic on seed-wasps of the genus *Megastigmus* Dalman, 1820 (Kamijo 1963) (Torymidae: Hymenoptera), but based on other host records it more likely was attacking one of the many species of cecidomyiids known to infest the seeds and cones of conifers (see Gagne 1989).

In this paper I describe a distinctive new species of *Torymoides*, which appears to be widespread, though uncommon, across the southern United States, with a single record from central Mexico. Its host is questionable, but it appears to be associated with cecidomyiids in grasses as discussed below.

MATERIAL AND METHODS

Acronyms used for museums are as follows:

- CAS – California Academy of Sciences, San Francisco, California, USA;
- CSCA – California State Collection of Arthropods, Sacramento, California, USA;
- UCD – University of California, R. M. Bohart Museum, Davis, California, USA;

UCR – University of California, Riverside, California, USA;
UK – University of Kansas, Lawrence, Kansas, USA;
USNM – National Museum of Natural History, Washington, DC, USA.

TAXONOMY AND DISTRIBUTION

Torymoides boucekianus sp. nov.

(Figs 1-7)

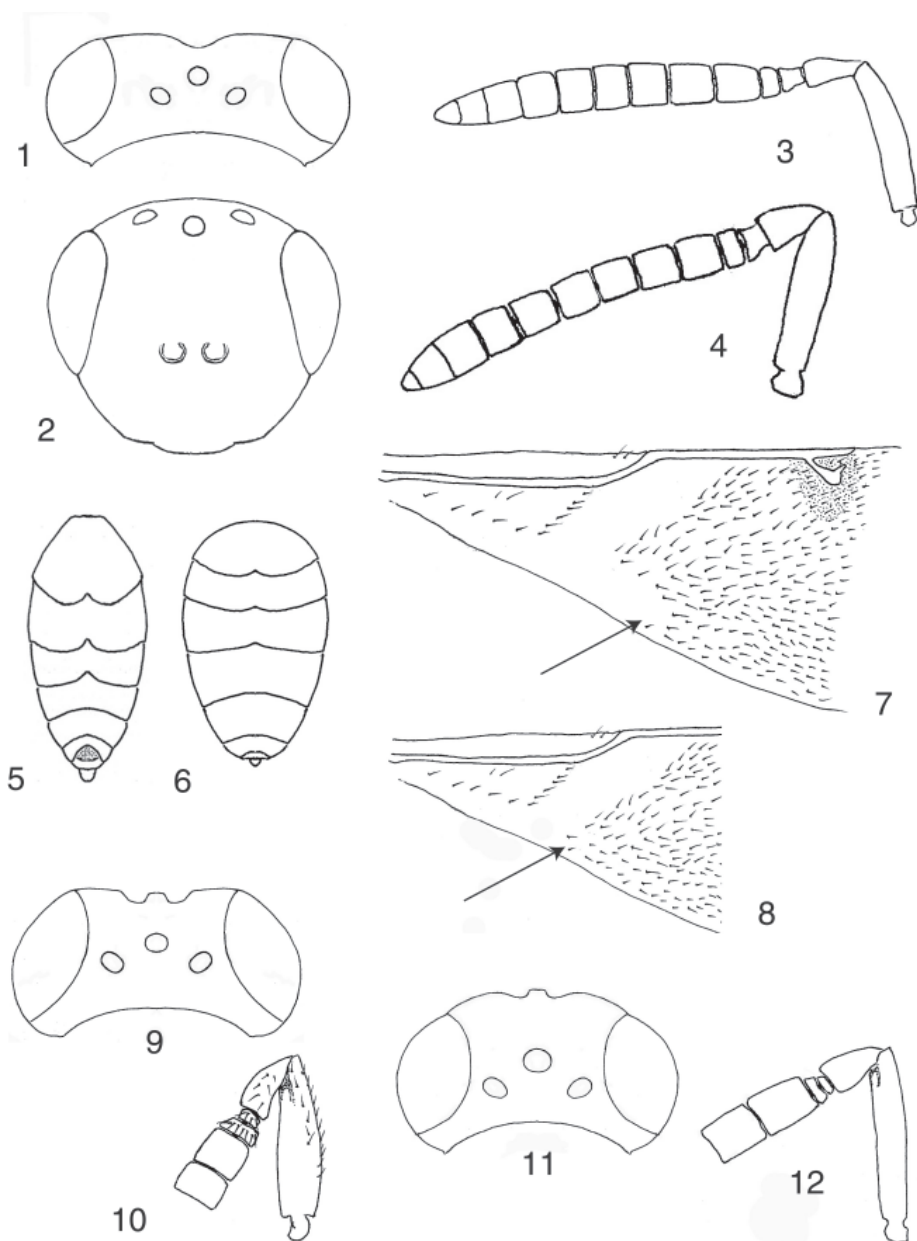
DESCRIPTION OF FEMALE HOLOTYPE. Body length 4.2 mm; ovipositor sheath 2.5 mm. Head metallic copper with green overtones; mesosoma and coxae metallic blue-green with purplish reflections; scape, legs, and metasoma matte reddish orange. Head and mesosoma finely, irregularly sculptured, distinctly reticulate on upper half of metacoxa; propodeum with irregular longitudinal carinae interspersed with amorphous transverse carinae and reticulate sculpture; metasoma completely covered with fine, coriaceous to aciculate sculpture. Head densely covered with evenly spaced, short white setae (half length of setae on mesosoma); following covered with sparse, evenly spaced, long white setae: mesosoma dorsally, metapleuron, callus, metacoxa on lower inner side (setae absent dorsally); sides of metasoma with short, sparse black setae. Metacoxa without dorsal setae; 3 or more long setae on inner surface.

Head. In dorsal view (Fig. 1) over twice as wide as long; in frontal view (Fig. 2) wider than high. Interocular distance about 1.5× malar distance which is about 0.5× eye height. Eyes at narrowest point separated by about 1.3× own height, with inner orbits diverging slightly ventrally. Ratio of lateral ocellus diameter:oculocellar distance:postocellar distance = 1:1.3:2. Clypeus with apical margin slightly curved. Torulus slightly above ventral margin of eye, separated by less than own diameter. Antenna (Fig. 3) with first anellus about as long as wide, distinctly narrower at base than apex; second anellus distinctly wider than long, shorter than first and of uniform width; funicle segments 1-2 longer than wide, 3-6 gradually becoming wider than long; flagellum evenly covered with appressed black setae; sensilla arranged in 2 rows on each segment; dorsum of scape, pedicel, and anelli with black, semi-erect setae; clava without ventral micropilosity.

Mesosoma. About 1.5× as long as wide, in profile propodeum sloping at about 60 degrees. Pronotum short, about 7× wider than long, with ill-defined collar sloping abruptly to occiput. Scutum with distinct notauli. Scutellum slightly longer than wide, moderately convex, without frenal line; scutellar flange barely perceptible, with single row of equal-sized, tiny pits; anterior margin essentially pointed (i.e., axillae nearly meeting medially). Propodeal spiracle separated from posterior margin of propodeum by about 0.6× longest diameter of spiracle; nucha scarcely discernable, merging into propodeal carinae. Metafemur about 3.5× as long as wide; metatibia with longer spur subequal in length to apical width of tibia, shorter spur about 0.5× length of longer one.

Forewing (Fig. 7) with faint brown infuscation surrounding stigmal vein; costal cell asetose dorsally, ventrally with several setal rows in apical third; basal and cubital veins setose, basal cell with 2 dorsal setae, evenly setose ventrally; speculum bare dorsally, open to posterior of wing, ventrally with sparse irregular setae; admarginal area essentially bare dorsally, line of dorsal setae distal to speculum forming diagonal line relative to marginal vein; ratio of submarginal vein:marginal vein: postmarginal vein: stigmal vein about 7:4:1:1; stigmal vein distinctly petiolate.

Metasoma (Fig. 5). About as long as head and mesosoma combined; metasomal tergum 1 (MT1, petiole) scarcely visible as transverse strip; MT2-4 apicomedialemarginate, MT2 deepest, MT3 and MT4 each becoming shallower, MT5-8 entire (margins difficult to see because of color and translucency); ratio of MT2:3:4:5:6:7:8 approximately 4:3:2:2:1:1; hypopygium extending to about 0.7× length of gaster; ovipositor sheaths slightly shorter than body length, about 2× length of metatibia.



Figs 1–12. *Torymoides boucekianus* sp. nov. (1–7). 1 – head, 2 – face, 3 – female antenna, 4 – male antenna, 5 – female metasoma 6 – male metasoma, 7 – forewing, arrow showing cubital and subcubital setal lines not reaching posterior margin of speculum. *T. sulcius* (Walker) (8–10). 8 – basal area of forewing, arrow showing cubital and subcubital setal lines reaching posterior margin of speculum, 9 – head, 10 – scape, anelli, and funicular segments 1, 2. *T. smithi* (Schread) (11, 12). 11 – head, 12 – scape, anelli, and funicular segments 1, 2. All in dorsal aspects except 2 frontal aspect; 3, 4, 10 and 12 lateral aspect.

Male. Body length 2.5-4 mm. As for female except: metasoma metallic green; antenna (Fig. 4) with funiculars all about as wide as long; metasoma dorsoventrally compressed, MT1 inconspicuous; MT2-4 (Fig. 6) slightly emarginate apicomediaally; MT5-8 concave, without distinct median emargination; ratio of MT2:3:4:5:6:7:8 about 6:3:4:5:5:2:1.

VARIATION. Females vary in length (including ovipositor) from about 5-8 mm. The relatively distinct matte reddish orange coloration of this species varies from yellowish to bright orange. This variation is also affected, in part, by illumination. Under normal incandescent and fluorescent light the intense orange color appears distinctly saturated. Under bright fiber-optic light, however, the reddish orange appears yellowish in some, but not all, specimens. In 3 specimens from Texas the coloration is straw yellow without any hint of red. In some females, one or two setae may be present on the dorsum of the basal cell.

TYPE MATERIAL. Holotype ♀, **California**, Yolo County, Davis, 16-VI-1966, C. R. Kovacic (in USNM). Paratypes, 61 ♀, 44 ♂, from the following localities (USNM unless stated otherwise). UNITED STATES. **Arizona**: Cochise Co.: 1 ♀, 5 mi. w. Portal, 6-VII-1955, O. L. Cartwright; 1 ♂, Portal, SW Research Station, 8-VII-1956, O. L. Cartwright, sweeping grass and weeds; 1 ♂, same locality, 12-VI-1956, L. J. Bottimer; 11 ♀, 4 ♂, Sunnyside Canyon, Huachuca Mts., 9-VII-1940, D. E. Hardy (UK); Santa Cruz Co.: 1 ♀, Patagonia, 26-VI-1936, E. D. Ball; 1 ♂, Tubac, 24-VI-1933. **Arkansas**: Arkansas Co.: 1 ♂, [county only], 6-VII-1927, D. G. Hall. **California**: 4 ♀, 3 ♂, Butte Co.: Chico, 24-27-VII-1939, W. B. Cartwright, "bred from *Cecidomyia* gall", Sacramento No. 31607; El Dorado Co.: 1 ♀, 7 mi. ne Wright's Lake, 4-VII-1969, R. L. Dunn; Glenn Co.: 1 ♀, Butte City, 7-VI-1987, D. E. Elliot, on rice (CSCA); Humboldt Co.: 2 ♀, Garberville, s. fork Eel River, 7/8-VIII-1982, M. S. Wasbauer (CSCA); Merced Co.: 1 ♀, 1 ♂, G. J. Hatfield State Park, 30-V-1959, C. G. Moore, F. D. Parker (UCD); Napa Co.: 3 ♀, 5.5 km NW Moskowite Corner, Capell Creek, 3-IX-1977, P. W. Arnaud (CAS); San Diego Co.: 2 ♀, Warner Springs, 17-VIII-1958, E. I. Schlinger (1 UCD, 1 USNM); Shasta Co.: 3 ♀, 1 ♂, Redding, 27-VIII-1988, T. R. Haig (CSCA); 5 ♀, 4 ♂, Yolo Co.: Knights Landing, 2-VIII-1967, California Department of Agriculture, sweeping; 1 ♀, Davis, 26-VIII-1956, A. T. McClay; 4 ♀, 6 ♂, 20-VI-1966, C. R. Kovacic (6 UCD, 5 USNM); 3 ♀, 18-VI-1975, B. Villegas (UCD); 1 ♀, 11-VIII-1955, A. D. Telford (UCD); 1 ♀, 2-VI-1971, N. M. Tomsen (UCD); 1 ♀, 27-VI-1970, S. R. Sims (UCD); 1 ♀, 13-XI-1979, L. A. West (UCD); 1 ♀, 1 ♂, Ramsey Canyon, 2-VI-1973, R. W. Thorp (UCD); 1 ♀, 7 mi. e. Woodland, 9-X-1974, R. W. Brooks (UCD); 1 ♂, 5 mi. ne Woodland, 27-VIII-1970 (UCD). **Florida**: Levy Co.: 1 ♀, 2 ♂, Cedar Key, 30-V to 25-VII-1976, E. E. Grissell, sweeping *Spartina patens* in salt marsh; 2 ♂, same locality, 12-VII-1939, R. H. Beamer; ; 4 ♂, same except Oman; 1 ♂, same except, D. E. Hardy (UK). **Louisiana**: Madison Co.: 1 ♀, Tallulah, 24-VI-1924, E. R. Kalmbach. **Texas**: Bell Co.: 1 ♂, 3 mi. w. Little River, R. Wharton; Cameron Co.: 1 ♀, Brownsville, 10-III-1945, E. D. Hardy; Collin Co.: 2 ♀, 5 ♂, Plano, IX-1947, E. S. Tucker, in corn; Hidalgo Co.: 1 ♀, Progresso, 12-IV-1950, Beamers, Stephen, Michener, Rozens (UD); Dallas Co.: 1 ♀, Dallas, 22-IX-1955, F. C. Bishopp; San Saba Co.: 1 ♂, San Saba, 1-VII-1936, R. H. Beamer (UK); Sutton Co.: 1 ♀, [county only], 16-VII-1928, R. H. Beamer (UK); Victoria Co.: 3 ♀, 1 ♂, Victoria, 24-VI-1924, J. D. Mitchell. **Utah**: Washington Co.: 1 ♀, St. George, 9-IX-1954, G. F. Knowlton (UK); MEXICO. **Hidalgo**: 1 ♀, 14 mi. sw Tula[ncingo], 12-IX-1972, B. Villegas, E. A. Kane (UCD). **Jalisco**: 1 ♂, 20 mi. w. Tacolotian, 15 IX-1938, L. J. Lipovsky (UK).

ETYMOLOGY. This species is named in honor of my friend and colleague, Zdeněk Bouček, whom I consider the world's foremost chalcidologist.

HOST. A few specimens were "bred from *Cecidomyia* gall" but no host plant was given. Specimens of this species have been collected in stands of salt-marsh grass (*Spartina patens* (Aiton) Muhlenberg) (Poaceae) in Florida and sweeping grasses near rivers in California. One specimen was collected in rice fields in California. Given the number of *Torymoides* known to attack cecidomyiids, the host is probably a gall-forming cecidomyiid in grass stems or seed heads and may possibly be associated with aquatic situations.

DISTRIBUTION. This species is transcontinental from California to Florida along the southern region of the United States. Two specimens have been collected in central Mexico (Hidalgo and Jalisco states).

DISCUSSION. Female *Torymoides boucekianus* sp. nov. are remarkable among all *Torymidae* I have examined by virtue of their bright matte reddish orange metasoma, legs, and scape. The color is reminiscent of yellow-colored Hymenoptera that have been kept in cyanide too long. Males have only the scape and legs thusly colored. The reddish-orange color contrasts sharply with the metallic blue-green of the mesosoma in both sexes and the metasoma in males.

In their descriptions of Argentinian *Torymoides*, Kieffer & Jorgensen (1910) make no mention of a bright orange-red (or even yellow) abdomen, so it is unlikely that *T. boucekianus* sp. nov. is one of the species described in their paper.

Additional morphological characters are given in the key to distinguish *T. boucekianus* sp. nov. from other Nearctic species.

***Torymoides sulcius* (Walker, 1839)**

(Figs 8–10)

Callimome sulcius Walker, 1839: 64.

DISTRIBUTION AND NEW RECORDS. Grissell (1995) recorded this species occurring from Texas and Florida south to Argentina. The following are new state records that extend the known distribution of this species considerably farther north.

MATERIAL STUDIED. **USA: Maryland:** Anne Arundel County: 1♀, Edgewater, 1956, J. D. Moser, gall on *Baccharis* (USNM); **Georgia:** Glynn County: 1♂, Brunswick, V-1960, F. O. Bennett, midge gall on *Baccharis* (USNM).

DISCUSSION. This is a widespread species, with numerous synonyms (Grissell 1995, Noyes 2003). *Torymoides sulcius* is known from a few cecidomyiid hosts and, considering its distribution, it would seem that it should be a common species found on many different species of cecidomyiids. In the Nearctic the only published record is a rearing from a cecidomyiid gall on *Baccharis halimifolia* L. (Asteraceae) in Florida (Ashmead 1887). There are specimens in the National Museum of Natural History, Washington, DC, reared from cecidomyiid galls on *Baccharis neglecta* Britton in Laredo, Texas, and from galls on *Baccharis* sp. in Maryland and Georgia. In Argentina the species was reared from larvae and puparia of *Trypanaresta valdesiana* Gandolfo and Norrbom (Tephritidae) on *Gutierrezia solbrigii* Cabrera (Asteraceae) (Gandolfo & Norrbom 1997).

Females of this species are easily identified based on the nearly all pale whitish yellow or orange mesosoma and metasoma including legs (the head is metallic green, as is the propodeum, and the lower epimeron). The male has the following areas all white: sides of the pronotum, tegula and surrounding area, the legs including fore- and midleg, and the metasoma except for a dorsal, transverse metallic green band. Other characters are given in the key.

***Torymoides smithi* (Schread, 1937)**

(Figs 11, 12)

Lochites smithi Schread 1937: 103.

DISTRIBUTION AND NEW RECORDS. This species has been known only from the state of Connecticut in the United States (Grissell 1995). The following are new state records.

MATERIAL STUDIED. **USA: Massachusetts:** 1♀, 6♂, “Melrs Hgds” [possibly Melrose Highlands, Middlesex County], 11–VI–1916, ex cecid gall on *Carya* sp., Timberlake (UCR). **Maryland:** 1♀, Montgomery County, Plummer’s Island, 3–VIII–1915, V. A. Roberts (USNM).

DISCUSSION. No information has been published on this species since its description based on 3 specimens from Connecticut. It was reared from a *Caryomyia* sp. gall (Diptera: Cecidomyiidae), but no host plant was specified (Schread 1937). According to Gagné (1989) this genus of gall-former occurs only on *Carya* spp. (Juglandaceae). One additional rearing cited below essentially confirms the host plant.

Males and females of this species are recognized in part by the entirely metallic green head, mesosoma, and metasoma. Other characters are given in the key.

Key to Nearctic species of *Torymoides*

- 1 Forewing with setal rows of cubital and subcubital veins extending as far as posterior margin of speculum (Fig. 8, arrow) and area around stigma hyaline though a faint brown band sometimes present adjacent to stigma; ocellular distance less than lateral ocellus diameter and postocellar distance greater than 3× ocellular distance (Figs 9, 11); both sexes with scape and legs (except coxae) white; female metasoma either metallic green or pale yellow-orange with spots.....2
- Forewing with setal rows of cubital and subcubital veins ending some distance before posterior margin of speculum (Fig. 7, arrow), and area around stigma (Fig. 7) stained brown for at least several stigmal vein lengths; ocellular distance greater than lateral ocellus diameter and postocellar distance less than 2× ocellular distance (Fig. 1); both sexes with scape and legs (except coxae) reddish orange; female metasoma matte reddish orange (rarely reddish yellow), without spots.....*T. boucekianus* sp. nov.
- 2 Both sexes: metacoxa and meso- and metasoma entirely metallic green; inconspicuous white setae present on dorsum of scape, dorsum of pedicel, and femora and coxae with longer white setae near apex; pedicel plus anelli shorter than first 2 funiculars (Fig. 12); cubital vein with 1 or 2 setae along posterior margin of basal cell*T. smithi* (Schread)
- Female: metacoxa, and meso- and metasoma non-metallic, pale with some combination of white, orange or yellow, metasoma with one or more lateral spots; male pronotum white laterally, metasoma white except for transverse median green band. Both sexes: conspicuous short, black setae present on dorsum of scape, dorsum of pedicel (Fig. 10), and femora and coxae with longer black setae near apex; pedicel plus anelli longer than first 2 funiculars (Fig. 10); cubital vein distinctly setose along posterior margin of basal cell (Fig. 8)*T. sulcius* (Walker)

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***Zdenekiella deon* gen. nov. et sp. nov. (Hymenoptera: Chalcidoidea, Encyrtidae), egg parasitoid of *Phonapate frontalis* (Coleoptera: Bostrichidae) from Libya**

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Abstract. A new genus and species of encyrtid (Hymenoptera: Chalcidoidea: Encyrtidae) reared from the eggs of Bostrichidae (Coleoptera) on date palm is described. Morphological and biological features suggest that *Zdenekiella deon* gen. nov. et sp. nov. belongs to the tribe Oobiina in the subfamily Encyrtinae. Differences from the closely related genera *Avetianella* Trjapitzin, 1968, *Oobius* Trjapitzin, 1963 and *Orianos* Noyes, 1990 are highlighted. A dichotomous key is provided to facilitate the identification of the known genera of Oobiina.

Taxonomy, new genus, new species, key, Hymenoptera, Chalcidoidea, Encyrtinae, Oobiina, date palm, frond borer, Coleoptera, Bostrichidae, Palaearctic region

INTRODUCTION

The frond borer, *Phonapate frontalis* (Fåhraeus, 1871) (Coleoptera: Bostrichidae), is a minor pest of the date palm, *Phoenix dactylifera* L. (Arecaceae). The species has been recently reported from Europe and develops in mines in palm leaves (López-Colón 1998). From eggs of *P. frontalis* collected in Libya, an interesting parasitoid emerged. Indeed, it belongs to an undescribed genus that we name in honour of Dr Zdeněk Bouček in celebration of his 80th birthday and in recognition of his contribution to Chalcidoidea systematics.

MATERIAL AND METHODS

Abbreviations used in the text include: F1, F2, etc., first funicle segment, second funicle segment, etc.; FV, minimum frontovertex width; FWL, maximum length of fore wing; FWW, maximum width of fore wing; GL, gonostylus (= third valvula) length; HW, maximum head width; MT, mid tibia length; MV, maximum length of marginal vein; OCL, occipital-ocellar line (= the shortest distance between posterior ocellus and occipital margin); OL, ovipositor length; OOL, ocular-ocellar line (= the shortest distance between posterior ocellus and adjacent eye margin); PMV, SMV, maximum length of postmarginal and submarginal veins respectively; POL, the minimum distance between posterior ocelli; SL, scape length (excluding radicle); SV, maximum length of stigmal vein; SW, maximum scape width.

***Zdenekiella* gen. nov.**

TYPE SPECIES. *Zdenekiella deon* sp. nov.

ETYMOLOGY. The genus is named in honour of Dr Zdeněk Bouček. Gender feminine.

DESCRIPTION. Head in facial view 1.2× as broad as long; malar space nearly 0.5× length of eye. Frontovertex nearly 0.4× head width; ocelli forming a right angle. Antennal scrobes deep and almost reaching anterior ocellus; interantennal prominence well developed; antennal torulus sep-

arated from mouth margin by two-thirds its own length and from other torulus by about 1.3× its own length. Antennal scape (Fig. 1) cylindrical, about 5.5× as long as broad; pedicel subconical longer than any funicular segment; funicle 6-segmented; clava 3-segmented, apex obliquely truncate. Mandible (Fig. 2) with three teeth, upper tooth sharpest, lower one shortest; maxillary palpus (Fig. 3) 4-segmented, labial palpus (Fig. 4) 3-segmented.

Thorax convex; visible part of mesoscutum 1.5× as broad as long, with notaular lines absent; scutellum about as long as broad. Mesoscutum with sculpture (Fig. 5) made of irregular ridges; scutellum with reticulate sculpture (Fig. 6) composed of small cells. Fore wing (Fig. 7) hyaline, about 2× as long as broad; linea calva interrupted by 2 small setae; filum spinosum present; submarginal vein (Fig. 8) with an apical hyaline break, parastigma a little broadened in apical third; costal cell with subparallel margins about 8× as long as broad with one line of setae dorsally along distal half; marginal vein as long as broad and as long as postmarginal vein; stigmal vein 1.3× as long as marginal vein. Mid tibial spur as long as basal mid tarsal segment.

Gaster about as long as thorax (23:20); cercal plates about halfway along gaster; paratergites absent. Ovipositor (Fig. 9) 1.3× as long as mid tibia and a little exserted, exserted part shorter than mid tibial spur; outer plate of ovipositor almost rectangular; gonostylus about 0.25× length of ovipositor. HOSTS. The type species has been reared from eggs of the palm frond borer *Phonapate frontalis* (Coleoptera: Bostrichidae).

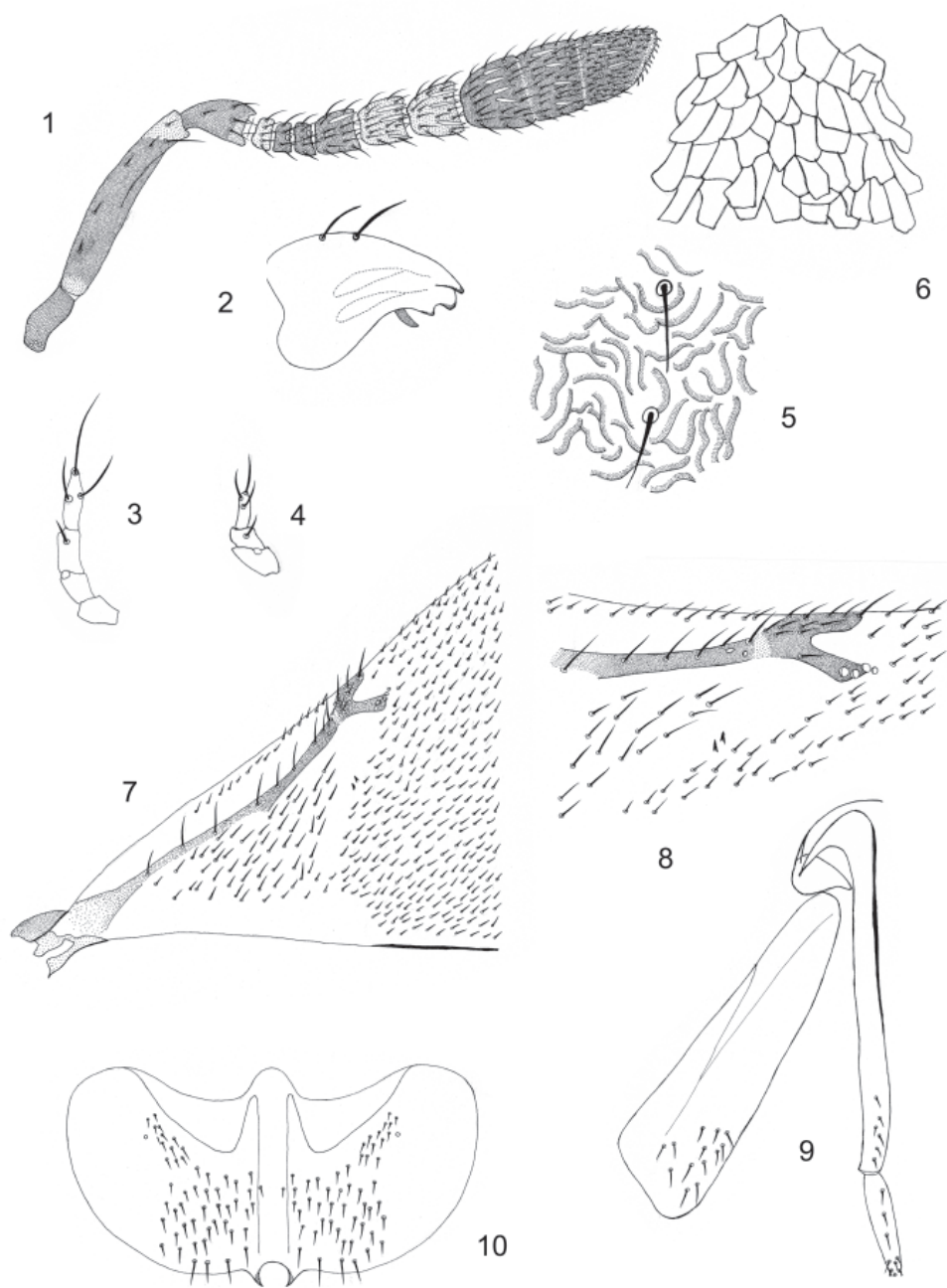
DISTRIBUTION. Known so far from Libya only.

COMMENTS. Records of Encyrtidae parasitising the eggs of Coleoptera are relatively few. In the most current catalogue of Chalcidoidea (Noyes 2003), they are recorded from *Ooencyrtus* Ashmead, 1900 and some related genera, and from the subtribes Oobiina and Cheiloneurina. *Zdenekiella* gen. nov. cannot be placed in any genera close to *Ooencyrtus* or in the Cheiloneurina because the mesopleuron is not expanded posteriorly and it is clearly separated from the base of the gaster whereas in all genera related to *Ooencyrtus* and those of the Cheiloneurini, the mesopleuron is clearly expanded posteriorly and touches the base of the gaster or nearly so. We believe that the combination of the obliquely truncate clava, the broadened parastigma, the interrupted linea calva, the unexpanded mesopleuron and biology clearly places *Zdenekiella* gen. nov. in the subtribe Oobiina. Females of this genus can be separated from those of other genera of the subtribe using the key presented below.

Key to genera of Oobiina (females)

1. Frontoververtex without membranous lines. 2
- Frontoververtex with membranous lines adjacent to inner eye margins and across frontoververtex below anterior ocellus. 3
2. Mandible with four teeth; clava obliquely truncate for half its length; mesoscutum with reticulate sculpture, each cell further divided by parallel ridges. *Orianos* Noyes, 1990
- Mandible with three teeth; clava obliquely truncate in apical one-third; mesoscutum with sculpture composed of irregular ridges. *Zdenekiella* gen. nov.
3. Clava 3-segmented. 4
- Clava entire. 5
4. Maxillary palpi 3-segmented; labial palpi 1-segmented. *Oobius* Trjapitzin, 1963
- Maxillary palpi 4-segmented; labial palpi 3-segmented. *Avetianella* Trjapitzin, 1968
5. Labial palpi 3-segmented. *Chrysomelechthrus* Trjapitzin, 1977
- Labial palpi 1-segmented. *Szelenyiola* Trjapitzin, 1977

In the most recent faunistic keys available for Encyrtidae (Noyes & Hayat 1984, Trjapitzin 1989), the new genus runs respectively to *Coccidoxenoides* Girault, 1915 and *Paralitomastix* Mercet, 1921 (= *Copidosoma* Ratzeburg, 1844 see Guerrieri & Noyes (2005)). Apart from belonging to a different subfamily of Encyrtidae, *Zdenekiella* gen. nov. can be conveniently separated from



Figs 1–10. *Zdenekiella deon* gen. nov et sp. nov., female. 1 – antenna; 2 – mandible; 3 – maxillary palp; 4 – labial palp; 5 – sculpture of mesoscutum; 6 – sculpture of scutellum; 7 – base of fore wing; 8 – fore wing venation; 9 – ovipositor; 10 – hypopygium.

Coccidoxenoides by having tridentate mandibles, whilst in *Coccidoxenoides* the mandibles are bidentate. *Zdenekiella* gen. nov. can be distinguished from *Copidosoma* by having a distinctly broadened parastigma and the placoid sensilla of the stigmal vein being arranged in two rows, whilst in *Copidosoma* the parastigma is more or less the same diameter as the submarginal vein and the placoid sensilla of the stigmal vein are arranged symmetrically in a square.

***Zdenekiella deon* sp. nov.**

(Figs 1–10)

DESCRIPTION. Female (holotype): length 0.9 mm.

Body entirely black with blue-green reflections; antenna (Fig. 1) dark brown, apex of scape, F1, F5 and F6 pale brown; fore wing (Fig. 7) hyaline, venation brown; legs dark brown, apices of all femora and tibiae, and base of tarsi yellowish.

Head about $2.8\times$ as wide as frontovertex; ocelli forming a right angle; posterior ocellus almost touching eye; antennal proportions as in Fig. 1 with scape about $5.5\times$ as long as broad, F1–F3 strongly transverse, F4–F6 abruptly larger than preceding segments and with linear sensilla; clava obliquely truncate at apex; mandible and palpi as in Figs 2–4. Relative measurements: HW 44, FV 16, POL 10, OOL <1 , OCL 8, SL 22, SW 4.

Fore wing (Fig. 7) about $2\times$ as long as broad, venation as in Fig. 8. Relative measurements: FWL 100, FWW 48, MV 3, PMV 3, SV 4.

Gaster with ovipositor slightly exerted.

Paratype. Ovipositor as in Fig. 9 about $1.3\times$ as long as mid tibia and $4\times$ as long as gonostyli; hypopygium as in Fig. 10. Relative measurements: OL 82, MT 60, GL 20.

ETYMOLOGY. The specific name is an arbitrary combination of letters.

HOSTS. The species has been reared from eggs of *Phonapate frontalis* (Coleoptera: Bostrichidae) collected on date palm, *Phoenix dactylifera* L.

DISTRIBUTION. Libya.

TYPE MATERIAL. Holotype ♀, LIBYA, Gialo, 19.v.2001, ex eggs of *Phonapate frontalis* on palm trees (legit Salah Agunna). Paratypes: 11♀, same data as holotype. Holotype and paratypes in the Natural History Museum, London, UK. One paratype will be deposited at Dipartimento di Entomologia e Zoologia Agraria, Università di Napoli “Federico II”, Portici (NA), Italy.

A c k n o w l e d g e m e n t s

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Observations on foraging and mating behaviour of *Euderomphale chelidonii* (Hymenoptera: Eulophidae)

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Abstract. The foraging and mating behaviour of *Euderomphale chelidonii* Erdős, 1966, an endoparasitoid of the cabbage whitefly, *Aleyrodes proletella* (Linné, 1758), is presented. Only some penetrations of the whitefly puparia by the parasitoid ovipositor result in egg laying, but oviposition punctures often are used for host haemolymph extraction; both sexes of the parasitoid feed on host fluids. The courtship repertoire of *Euderomphale chelidonii* is complex. The most significant features of the mating behaviour of *E. chelidonii* are: the grasping of the female flagella between the male's scape and pedicel, followed by the tapping of the female's flagella by the tarsi of the male's middle legs. The antero-lateral abdominal glands of *E. chelidonii* are everted and retracted when the wasp exerts some extra effort (e.g. when forcibly retained or moistened); also the antennal contacts of these glands generally precede the male courtship activity, suggesting an intraspecific signaling function for these glands.

Ethology, foraging, mating, ovipositing, natural enemies, biological control, Hymenoptera, Eulophidae, Hemiptera, Aleyrodidae, Ukraine, Palearctic region

INTRODUCTION

The whiteflies (Hemiptera: Aleyrodidae) are an economically important group of insects, damaging wide variety of plants. Whiteflies are more pesticide-resistant compared to other sucking pests because the nymphs are well-protected by the external cases of their puparia. The most perspective area of their control is therefore the use of natural enemies, in particular parasitoids that attack the immature stages.

Among Chalcidoidea most parasitoids of whiteflies belong to the families Aphelinidae (chiefly the genera *Encarsia* Förster, 1878 and *Eretmocerus* Haldeman, 1850, both of nearly cosmopolitan distribution) and Eulophidae (mainly species of the tribe Euderomphalini). In the European fauna the whitefly parasitoids of the latter family are represented only by the genus *Euderomphale* Girault, 1916.

There were some recent revision taxonomic works on the tribe Euderomphalini (LaSalle & Schauff 1994, LaSalle 1999, LaSalle & Polaszek 2000, Hansson & LaSalle 2003) and on biology of some species of *Euderomphale* (Mazzone 1988, Williams 1989, Gerling 1990). However, many biological characteristics (e.g. behaviour, distribution, host preferences) of Euderomphalini remain undiscovered.

The cabbage whitefly, *Aleyrodes proletella* (Linné, 1758) (Fig. 1) has a comparatively wide spectrum of host plants, damaging species in the families Apiaceae, Asteraceae, Balsaminaceae, Berberidaceae, Brassicaceae, Campanulaceae, Euphorbiaceae, Fabaceae, Fagaceae, Papaveraceae, Ranunculaceae, and Scrophulariaceae. Trjapitzin et al. (1996) reported its damage to *Chelidonium majus*, *Brassica oleracea*, *Euphorbia* sp., *Lactuca triangulata* and *Lactuca* spp. Larvae,

puparia and adults inhabit the undersides of leaves (the greater celandine, *Chelidonium majus*, in particular), and may be found in a wide range of biotopes in Ukraine.

Specimens of *Euderomphale chelidonii* Erdős, 1966, an endoparasitoid of *Aleyrodes proletella*, were recently collected in field in Kiev (Ukraine) and observed in laboratory by the author. Some of these behavioural observations are reported here.

MATERIALS AND METHODS

Observations were made on *Chelidonium majus* plants in two main areas in Kiev: the Trukhaniv Island and Solomenka district. Colonies of *Aleyrodes proletella* were searched for adult parasitoids walking on the leaves or ovipositing into the host puparia. Adults were collected with an aspirator and put into Petri dishes with exposed leaves (underside up) of greater celandine infested by *A. proletella*.

Videorecordings were made using 8mm VP-A800 Pal Samsung Video Camera, followed by digitalization in AVerTV Studio program (model 203, AVerMedia Technologies, Inc.). The camcorder was connected to the binocular microscope (MBS-10) and recordings were done with the „manual focus“ option enabled. The scanning electron microscopy (SEM) photographing was carried out in the Max-Planck Institute for Metal Research (Stuttgart, Germany, MPI) using an LEO 1530VP microscope.

After studying the behaviour, specimens were preserved as vouchers in the collection of the Schmalhausen Institute of Zoology of the National Academy of Sciences of Ukraine, Kiev.

MATERIAL EXAMINED. 70♀, 12♂, Kiev, Trukhanov Island, captured when ovipositing into puparia of *Aleyrodes proletella* on *Chelidonium majus*, 08–30.viii.2003 (leg. Gumovsky); 83♀, 27♂, Kiev, Solomenka, captured when ovipositing into puparia of *A. proletella* on *Ch. majus*, 01–18.IX.2003 (leg. Gumovsky).

RESULTS

HOSTS. The most reliable hosts of this parasitoid are *Aleyrodes lonicerae* Walker, 1852 (Huldén 1986, Mazzone 1988, Williams 1987) and *A. proletella* (Williams 1989). It was also recorded as a parasitoid of *A. fragariae* Walker, 1852 (Hokkanen et al. 2002) and *Trialeurodes vaporariorum* (Westwood, 1856) (Skhirtladze 1993, Hokkanen et al. 2002) in greenhouses, but these records require confirmation. In our laboratory experiments females of *E. chelidonii* were examining the puparia of *T. vaporariorum*, however, no attempts to pierce the puparia were observed.

DISTRIBUTION. Europe (Bouček & Askew 1968, Trjapitzin 1976), Finland (Huldén 1986), Sweden (Hansson 1987), Netherlands (Hokkanen et al. 2002), Ukraine (new record).

OCCURRENCE. *Euderomphale chelidonii* was found in Ukraine from late-May to mid-November. Females generally concentrate on underside of leaves of greater celandine, searching for host puparia. In the field, individuals of *E. chelidonii* congregated in high number (up to 20 specimens per leaf) in biotopes bordering of some natural boundaries (e.g. hedges, stone walls). Otherwise, the parasitoids are present usually in low number of 1–4 per leaf on leaves that are densely infected by the host. Males occur in lower number, on average 3 males per 20 females per sample.

FORAGING BEHAVIOUR AND OVIPOSITION (Fig. 2). In no-choice laboratory experiments nearly every puparium was parasitized. Female antennate the leaf surface until a whitefly puparium is found. As soon as the puparium is discovered it is touched by the antennae in some places for some seconds, and oviposition begins soon afterwards.

Female bends its gaster down, pierces the puparium and nearly immediately its ovipositor deeply penetrates the puparium. Often these penetrations do not result in eggs deposition but still cause haemolymph to flow from the oviposition puncture. Both, females and males of *E. chelidonii* were found to feed actively on the haemolymph of *Aleyrodes proletella*. This feeding lasts from 10–15 seconds to about 1–1.5 minutes. The penetration of the host puparium is followed by active movements of the ovipositor inside of the puparium. Meanwhile the parasitoid female is twisting around.



Fig. 1. *Aleyrodes proletella* (Linné). (a) female laying eggs, (b) eggs (enlarged), (c, d) eggs, young larvae and puparia.

MATING BEHAVIOUR (Figs 3, 4). A male *Euderomphale chelidonii*, having perceived a female, mounts her and protrudes frontally (Fig. 3: A–C). Immediately at the beginning of the performance, the male stretches his fore leg forward to grasp the female's scape, and pulls the female's flagella off by his foretarsi. So that the female's flagella are oriented upwards. At the moment of grasping the female's antennae, his mid legs are in their normal position but they however, they do not touch the female's body. Then the male briefly caresses each female flagellum with the lower portion of his antennal scape (his pedicelli and flagella are not used). This stage lasts for 4–5 seconds. The male then manoeuvres his antennae in such a way that ventral area of the female antenna's clava is grasped between his enlarged and swollen scape (Fig. 5) and pedicel. Simultaneously the middle legs are moved forwards. The grasp (Figs 3: D–G; 4: A, B) lasts for about 4 seconds. Then antennal contact is broken: the male raises his antennal scapes and releases his flagella (Figs 3: H, I). This cessation of antennal contact ends the low phase of the mating behaviour (following van den Assem 1986) and is immediately followed by peculiar tapping movements (Figs 3: J; 4: C–E). The male keeps holding the female's antennae (her flagella oriented upward) with his fore legs, and taps

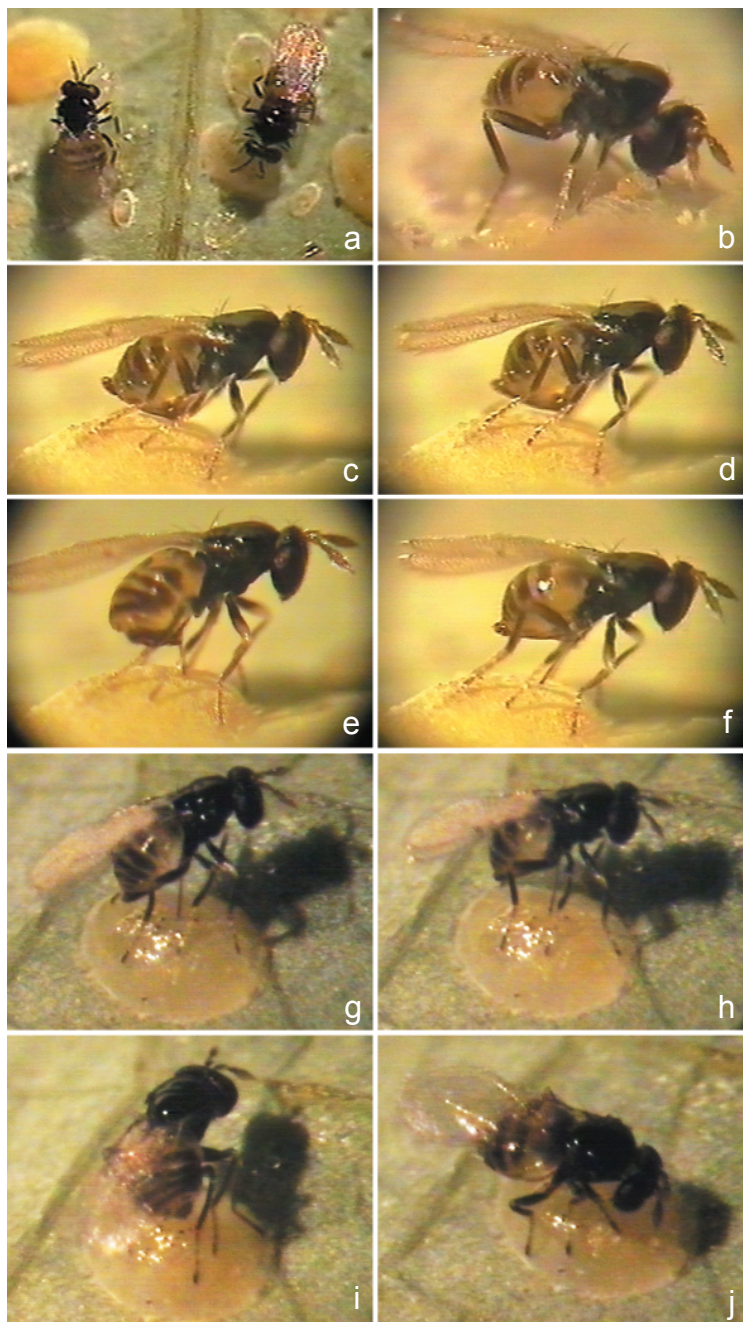


Fig. 2. *Euderomphale chelidonii* (Erdős). (a) females examining host puparia, (b) female feeding on host haemolymph; (c–j) female ovipositing.

the female's flagella by the tarsi (mainly basitarsi) of his middle legs. He also simultaneously touches the female's eyes with the posterior portions of his fore legs. The tapping lasts longer than the previous stage, in about 10–30 seconds. Then male moves back quickly (Fig. 4: F) and either copulation occurs, or the male walks off. No wing vibration by the male was observed either before or during the courtship of *E. chelidonii*.

DISCUSSION

The courtship behaviour of *Euderomphale chelidonii* corresponds in general to the pattern of courtship movements described for other Chalcidoidea (e.g., van den Assem 1975, 1985, van den Assem & Gijswijt 1989, van den Assem 1986). However, the mating repertoire of this species encompasses some peculiar movements, which either have not been recorded earlier (e.g., the tapping of the female antenna by the male's middle legs), or occur rarely (i.e. the male embracing the female antennae). These data may then be used in phylogenetic considerations and morpho-biological implications.

Other behaviouristic notes

LaSalle & Polaszek (2000) reported the presence of antero-lateral abdominal glands (ALAGs) in *Euderomphale* species. The function of the ALAGs is still unknown. One possible hypothesis is that these glands may be used in response to disturbance.

Our observations demonstrate that both sexes of *E. chelidonii* evert and retract the ALAGs when applying extra efforts, e.g. when stuck to a whitefly's excretion or to a drop of water. This may be an indirect support for the idea of intraspecific signalling, such as an aggregation or alarm pheromone, since the ALAG retractions and eversions were observed in abnormal situations.

Also, in our experiments, the mating behaviour of males of *E. chelidonii* males generally followed the antennal contacts with the upper sides of the female gaster (the ALAG areas). This suggests the possibility of intraspecific signalling of the ALAGs.

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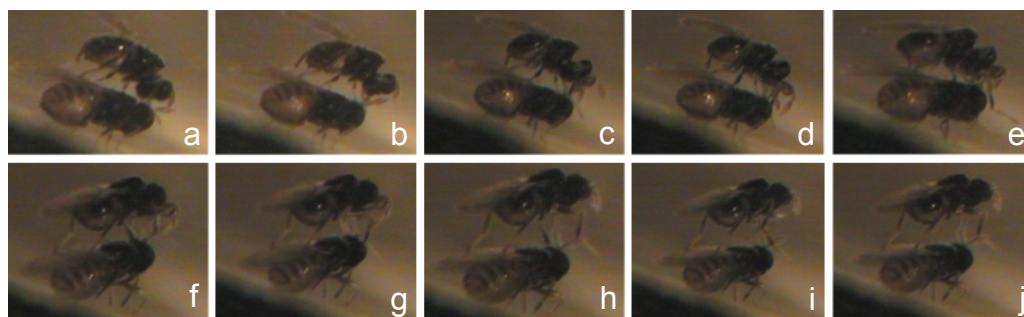


Fig. 3. Mating behaviour of *Euderomphale chelidonii* (Erdős). (a–c) male caressing the female antennae; (d–g) male grasping the female flagella between his antennal scape and pedicel; (h, i) male releasing the female's flagella (his middle legs oriented forwards); (j) male tapping the female flagella with his middle legs.

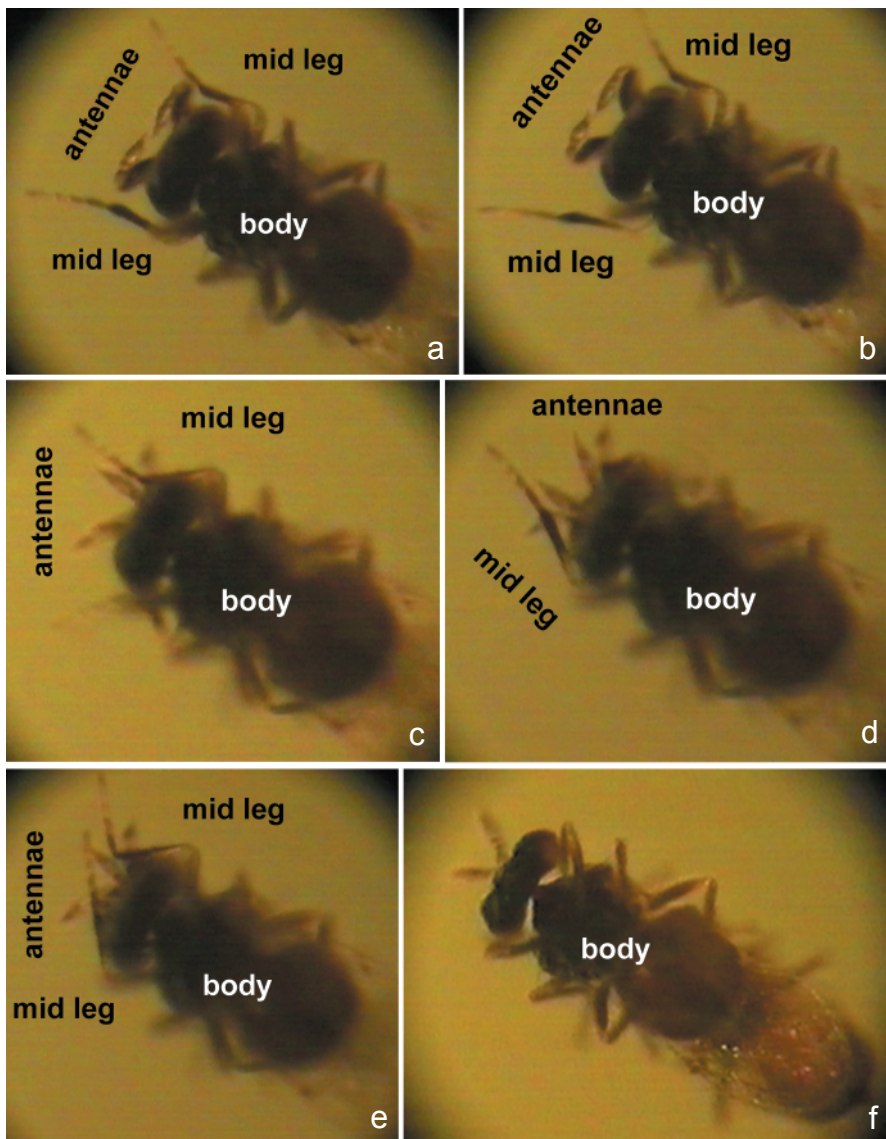


Fig. 4. Mating behaviour of *Euderomphale chelidonii* (Erdős), view from underside. (a, b) male grasps the female flagella by his antennae (his mid legs oriented forwards); (c–e) male knocks the female's flagella by his mid legs; (f) male moves back to copulate; female body is marked in white, male bodyparts, in black.

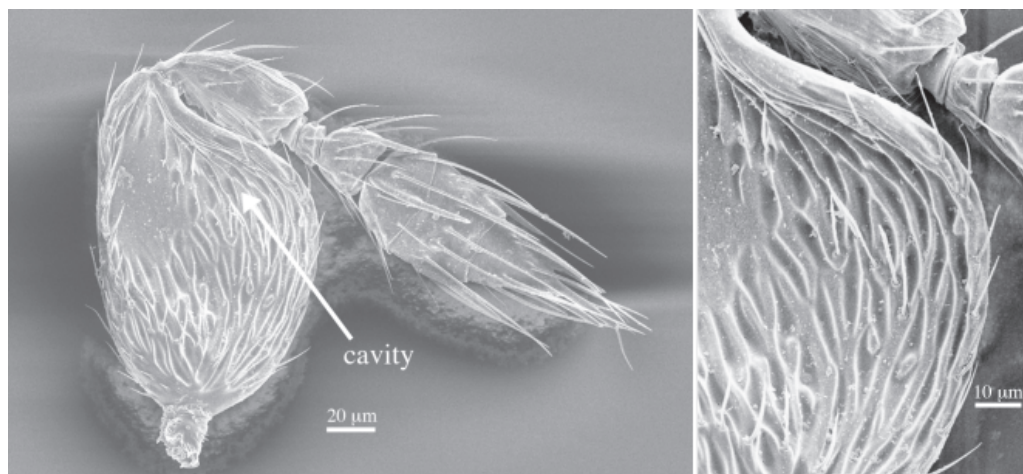


Fig. 5. *Euderomphale chelidonii* (Erdős). Male antenna, lateral projections (SEM); cavity on inner surface of scape indicated by arrow and enlarged (left).

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***Klyngon*, gen. nov. (Hymenoptera: Eulophidae) with two new species from Costa Rica**

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Abstract. A new genus, *Klyngon*, is described, including two new species, *Klyngon bouceki* sp. nov. and *K. jimenezi* sp. nov., both species from Costa Rica. *Klyngon jimenezi* sp. nov. has been reared from galls of Cecidomyiidae on *Serjania mexicana* (L.) (Sapindaceae). The new genus belongs in subfamily Entedoninae but is otherwise difficult to place due to a mosaic possession of characters.

Taxonomy, new genus, new species, Hymenoptera, Eulophidae, gallmidges, Diptera, Cecidomyiidae, Neotropical region

INTRODUCTION

The Neotropical fauna of Eulophidae has received some attention in the last couple of years, including several taxonomic and biologic contributions (e.g. Schauff & Janzen 2001, Hansson 2002, Hansson & LaSalle 2003). The Neotropical eulophid fauna is partly made up of genera known from other parts of the World – notably from the Nearctic Region. Apart from these well-known genera, a number of species belonging to other undescribed genera occur in the Neotropics, some of which don't look like anything known previously and, based on morphological features, are not easily fitted within the existing taxonomic frame-work. Here one of these odd genera is described.

ACRONYMS OF MUSEUMS

BMNH – Natural History Museum, London, United Kingdom;
CH – collection of the author Department of Cell and Organism Biology, Lund, Sweden;
INBio – Instituto Nacional de Biodiversidad, Santo Domingo, Costa Rica;
MIUCR – Museo de los Insectos, Universidad de Costa Rica, San Pedro, Costa Rica;
USNM – United States National Museum of Natural History, Washington, D.C., USA.

***Klyngon* gen. nov.**

TYPE SPECIES. *Klyngon jimenezi* sp. nov.

DIAGNOSIS. Frontal suture absent (Fig. 5); antennal scrobes as narrow and distinct grooves (Fig. 5); clypeus delimited by a groove laterally and dorsally (Fig. 6); pronotum strongly reduced, not visible in dorsal view (Figs 1, 2); propodeum with plicae, with a strong median carina and with reticulate grooves laterad to median carina (Fig. 7); propodeum with a distinct nucha; gastral tergites reticulate with posterior margin smooth (Fig. 3); male gaster with an enlarged subgenital plate (i.e. the 9th sternite) (Fig. 11), plate is strongly reticulate.

DESCRIPTION. Flagellum with sensilla ampullacea short and asymmetric, present on all flagellomeres; males with scattered setae (Fig. 10). Antenna with discoid anelli. Mandibles with two large teeth at apex (Fig. 6). Clypeus delimited (Fig. 6). Malar sulcus absent. Frontal suture absent. Antennal scrobes as narrow and distinct grooves. Occipital margin with a sharp edge; occiput without median groove or fold above occipital foramen.

Pronotum reduced, not visible in dorsal view. Midlobe of mesoscutum with two pairs of setae, notauli not visible. Scutellum with one pair of setae. Transepimeral sulcus strongly curved (Fig. 4); lower mesepimeron strongly reticulate. Fore wing rounded; costal cell narrow, as wide as base of submarginal vein; postmarginal vein $1.0\text{--}1.2\times$ as long as stigmal vein; speculum open below; radial cell hairy; without stigmal hair lines. Hind tibial spur stout, $5\times$ as long as width at base. Propodeum with plicae and medially with a strong median carina, carina reticulate and with reticulate grooves laterad to median carina (Figs 1, 2, 7), and with a nucha; propodeal callus with two setae.

Gastral tergites reticulate with posterior margin more or less smooth (Fig. 3). Male phallobase similar to the majority of entedonines (Fig. 12): parameres not drawn out and not distinguishable from remaining sclerites in the phallobase, parameral setae absent; volsellar setae as thin “normal” setae, i.e. not enlarged; digitus as long as wide, with two equally large spines. Male gaster with a large subgenital plate, surface of plate strongly reticulate (Fig. 11).

HOSTS. One of the species has been reared from galls of an unknown gall midge (Diptera: Cecidomyiidae) on *Serjania mexicana* (L.) (Sapindaceae).

DISTRIBUTION. The Neotropical Region (Costa Rica).

REMARKS. The gender of this new genus is neuter.

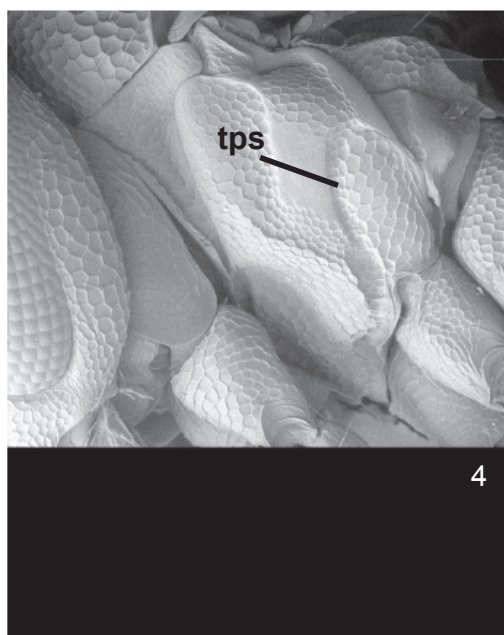
DISCUSSION. *Klyngon* gen. nov. belongs in subfamily Etedoninae. The five-segmented antennal flagellum, the submarginal vein with two strong setae, the break between submarginal and marginal veins, the two pairs of setae on midlobe of mesoscutum, the single pair of setae on scutellum, confirm such a placement. However, it is an odd genus with diagnostic features combined from different groups. For example the head in frontal view (Fig. 5) strongly resembles that of many pteromalids and some tetrastichines, mainly due to the lack of frontal suture; the delimited clypeus and strongly reduced pronotum are also found in the genus *Omphale* Haliday, 1833 and related genera (Hansson 2004) and in some genera in the tribe Euderomphalini (Hansson & LaSalle 2003); the structure of the propodeum, i.e. the strong plicae, the strong median carina with reticulate grooves lateral to the median carina, and the produced nucha resembles the propodeum in *Paracrias* Ashmead, 1904 (Hansson 2002) and *Horismenus* Walker, 1843, and in some species of *Pediobius* Walker, 1846 (Hansson 2002).

Klyngon jimenezi sp. nov.

(Figs 1, 3–5, 7, 9–12)

TYPE MATERIAL. Holotype female labeled “Costa Rica: Guanacaste, Hojancha, ACT, Reserva Forestal Monte Alto, camino-albergue, 500 m, 25.vii.2001, I. Jiménez, LN 221650/382750, en agallas de *Serjania mexicana*” (INBio). Paratypes: 4 females 7 males with same label data as holotype (BMNH, CH, INBio, MIUCR); 1 female “Costa Rica: Guanacaste, Bagaces, Parque Nacional Palo Verde, Sct Palo Verde, 40 m, 8–17.ii.2001, I. Jiménez, LN 388400/259050, #61364” (USNM); 1 female “Costa Rica: Alajuela, Parque Nacional Arenal, La Peninsula, $10^{\circ}27'N$, $84^{\circ}45'W$, 600 m, 25.ii.2003, J.S. Noyes” (BMNH); 1 female “Costa Rica: Limón, Valle La Estrella, 100 m, 8.iv–15.v.1994, G. Carballo, LN 184600/643300, #3146” (INBio); 1 female from same locality as previous but collected 17.vii.2000 (CH).

DIAGNOSIS. Female flagellum with a two-segmented clava (Fig. 9), male with all five flagellomeres distinctly separated (Fig. 10); malar space narrow, $0.1\times$ as wide of height of eye in female, $0.3\times$ in male; reticulation on thoracic dorsum with comparatively larger meshes (Fig. 1) (as compared to *Klyngon bouceki* sp. nov.); fore wing with a complete infuscate band medially.



Figs 1–4. *Klyngon jimenezi* gen. et sp. nov., thoracic dorsum, female paratype (1). *K. bouceki* gen. et sp. nov., thoracic dorsum, female holotype (2). *K. jimenezi* gen. et sp. nov., gaster, dorsal, female paratype (3). *K. jimenezi* gen. et sp. nov., mesosoma, lateral, female holotype (tps, transepimeral sulcus) (4).

DESCRIPTION. Length female 1.4–1.6 mm, male 1.0–1.3 mm.

Scape yellowish-brown, remainder of antenna dark brown. Frons and vertex weak metallic bluish-green. Mesoscutum weak golden with some parts weak metallic bluish-green, to completely weak golden. Scutellum with posterior 2/3 weak golden and anterior 1/3 weak metallic bluish-green, to completely weak golden. Propodeum weak golden. Coxae weak metallic bluish-green; femora and tibiae dark brown with metallic tinges; tarsal segments 1–3 white, segment 4 dark brown. Fore wing with median 1/5 infusate from marginal vein to posterior margin of wing. Gaster with 1st tergite weak metallic bluish-green, remaining tergites weak golden-purple.

Antennae as in Figs 9, 10. Frons and vertex with strong reticulation. Occipital margin with a sharp edge. Eyes bare. Ratios of: height of eye/malar space/width of mouth opening female 8.8/1.0/4.4, male 3.2/1.0/2.0; distances between posterior ocelli/between posterior ocellus and eye/between posterior ocelli and occipital margin 4.3/2.0/1.0; width of head/width of thorax across shoulders 1.2.

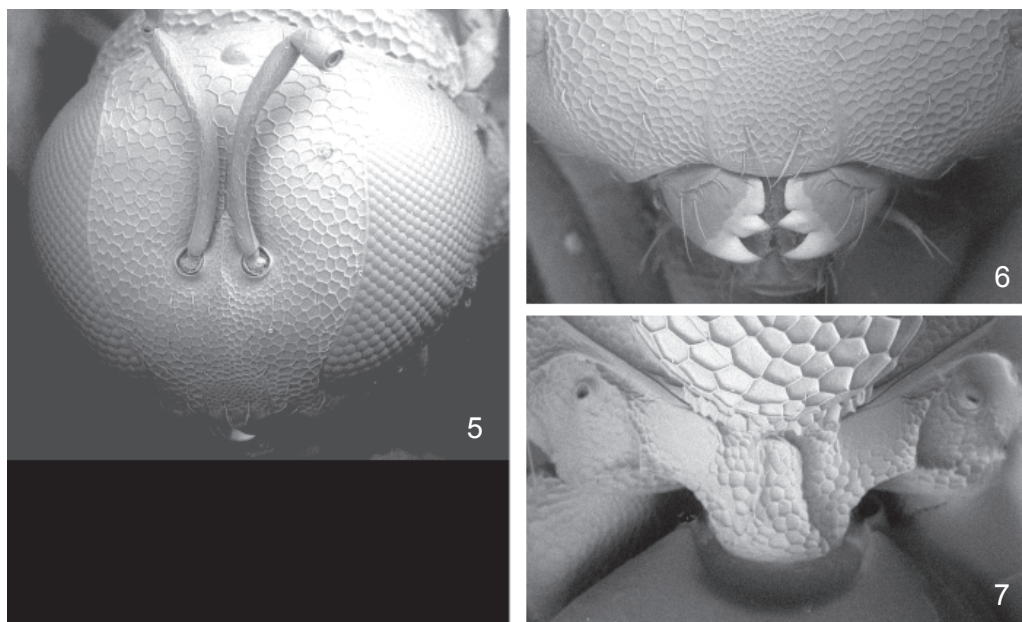
Mesoscutum and scutellum with strong reticulation. Dorsellum strongly reticulate. Fore wing speculum open below. Propodeum as in Fig. 7; propodeal callus with two setae. Ratios of: length of fore wing/length of marginal vein/height of fore wing 1.7/1.0/1.0; length of postmarginal vein/length of stigmal vein 1.0.

Petiole about as long as wide in both sexes, with strong irregular sculpture. Female gaster ovate; tergites in both sexes reticulate with posterior margin smooth (Fig. 3). Ratio length of mesosoma/length of gaster female 0.9–1.0, male 1.0.

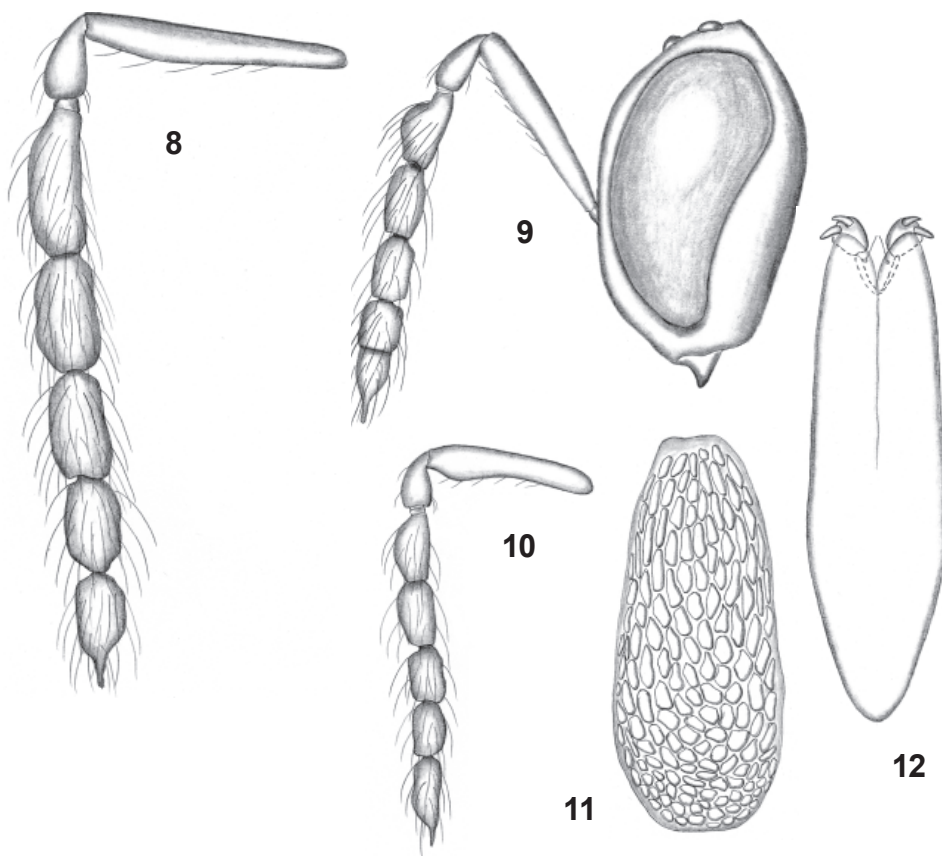
BIOLOGY. Reared from Cecidomyiidae (species unknown) galls on *Serjania mexicana* (Sapindaceae).

DISTRIBUTION. Costa Rica.

ETYMOLOGY. Named after the collector of the type series, Iván Jiménez, formerly a Hymenoptera parataxonomist at INBio.



Figs 5–7. *Klyngon jimenezi* gen. et sp. nov., head, frontal, female paratype (5). *K. bouceki* gen. et sp. nov., lower part of head incl. clypeus, female paratype (6). *K. jimenezi* gen. et sp. nov., propodeum, female paratype (7).



Figs. 8–12. *Klyngon bouceki* gen. et sp. nov., antenna, female (8). *K. jimenezi* gen. et sp. nov., head and antenna, lateral, female (9). *K. jimenezi* gen. et sp. nov., antenna, male (10). *K. jimenezi* gen. et sp. nov., subgenital plate, male (11). *K. jimenezi* gen. et sp. nov., phallobase, male (12).

***Klyngon bouceki* sp. nov.**
(Figs 2, 6, 8)

TYPE MATERIAL. Holotype female labeled “Costa Rica: Alajuela, San Carlos, Parque Nacional Arenal, Sendero Pilón, 650 m, 5.ix–7.x.2000, G. Carballo, LN 269200/458050, #59234” (INBio). Paratypes: following from same locality as holotype but collected 9.iii–7.iv.2000 (1 female, BMNH), 15.iii–5.iv.2001 (1 female, USNM); 1 female “Costa Rica: Guanacaste, Estación Pitilla, 9 km S. Santa Cecilia, 700 m, i.1995, P. Rios, LN 329950/380450, #4498 (CH).

DIAGNOSIS. Female with all five flagellomeres distinctly separated (Fig. 8); malar space wide, $0.4\times$ as wide as height of eye in female; reticulation on thoracic dorsum with comparatively smaller meshes (Fig. 2) (as compared to *Klyngdon jimenezi* sp.nov.); fore wing hyaline.

DESCRIPTION (female). Length of body 1.4–1.6 mm.

Scape yellowish-brown, remainder of antenna dark brown. Frons and vertex weak metallic bluish-green. Mesoscutum weak golden-purple with some parts weak metallic bluish-green, to completely weak golden-purple. Scutellum with posterior 2/3 weak golden-purple and anterior 1/3 weak metallic bluish-green, to completely weak golden-purple. Propodeum weak golden-purplish. Coxae, femora and tibiae weak metallic bluish-green; tarsal segments 1–3 yellowish-brown, segment 4 dark brown. Wings hyaline. Petiole dark. Gaster with 1st tergite weak metallic bluish-green, remaining tergites weak golden-purple.

Antenna as in Fig. 8. Frons and vertex with strong reticulation. Occipital margin with a sharp edge. Eyes bare. Ratios of: height of eye/malar space/width of mouth opening 2.5/1.0/1.9; distances between posterior ocelli/between posterior ocellus and eye/between posterior ocelli and occipital margin 3.3/2.1/1.0; width of head/width of thorax across shoulders 1.2.

Mesoscutum and scutellum with strong reticulation. Dorsellum with strong reticulation. Fore wing speculum open below. Propodeum as in Fig. 2; propodeal callus with two setae. Ratios of: length of fore wing/length of marginal vein/height of fore wing 1.8/1.0/1.0; length of postmarginal vein/length of stigmal vein 1.2.

Petiole about as long as wide, with strong irregular sculpture. Gaster ovate. Ratio length of mesosoma/length of gaster 0.9.

Male. Unknown.

BIOLOGY. Unknown.

DISTRIBUTION. Costa Rica.

ETYMOLOGY. Named after Zdeněk Bouček, grand old man of chalcidology, and the subject of this celebratory volume of *Acta Societatis Zoologicae Bohemicae*.

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A revision of the genus *Isomerala* (Hymenoptera: Eucharitidae)

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Abstract. *Isomerala*, 1894 is a genus recognized by distinctive nipple-shaped eyes. Two species are currently described, *I. coronata* Westwood, 1874 (Brazil) and *I. azteca* Girault, 1920 (Mexico and Guatemala; lectotype newly designated). One additional species is described from Venezuela and Trinidad, *Isomerala bouceki* sp. nov. The first instar larva (planidium) of *I. azteca* is newly described. The phylogenetic and host relationships of *Isomerala* within Eucharitidae, and the morphological and molecular variation within *I. azteca* are discussed. Nomenclatorial changes within Eucharitidae included in the appendix are a new replacement name (*Mimistaka* nom. nov.) for *Risbecia* Heraty, 2002, non *Risbecia* Odhner, 1934, and fixation of the name *Pseudochalcura excrucata* Heraty, 1986.

Taxonomy, new species, lectotype designation, nomenclatorial changes, key, larva, ant parasitoids, Formicidae, Ectatomminae, *Ectatomma*, Nearctic region, Neotropical region

INTRODUCTION

All of the Eucharitidae *sensu stricto* (Oresemurinae + Eucharitinae) are known to be ant parasites (Heraty 2002, Heraty et al. 2004). Within Eucharitinae, the parasitoids of large poneromorph and myrmecine ants belong to a monophyletic group that includes what were termed the Chalcura, Schizaspidia and Kapala clades (Heraty 2002, Heraty et al. 2004). The Kapala clade is a monophyletic, primarily neotropical group that attack ants in the genera *Ectatomma*, *Odontomachus* and *Pachycondyla* (Heraty 2002). This clade is restricted to the southern USA and Central and South America, except for a single species, *Kapala ivorensis* Risbec, which occurs throughout sub-Saharan Africa and Madagascar, and is presumed to be a relatively recent colonization event (Heraty 2002).

Isomerala is a distinctive member of the Kapala clade within the Eucharitinae. The odd nipple-shaped eyes have always made this genus easy to recognize as a distinct monophyletic group within Eucharitidae. The relationships of *Isomerala* within the Kapala clade are fairly well resolved. Based on a morphological character analysis, *Isomerala* is placed as closely related to either *Galearia* or *Dilocantha*, within a clade that includes *Kapala* (Heraty 2002). With molecular data, the Kapala clade is indicated as monophyletic, but *Kapala* is unresolved (potentially paraphyletic) with respect to *Isomerala* (Heraty et al. 2004).

All of these large poneromorph parasitoids have a very similar biology and method of attacking the host ants. Eggs are usually placed within existing cavities in plant tissue or scattered on the underside of leaf surfaces (Clausen 1940, Heraty 2002). The first-instar larvae (planidia) are very active and are presumed to attach to foraging ant workers for transport to the ant nest (Clausen 1940). Planidia are external parasites of the host ant larva, with further development occurring on the host pupa within the cocoon (Heraty 2002, Heraty et al. 2004).

Isomeralla coronata was first recorded as a parasite of *Ectatomma tuberculatum* (Formicidae: Ectatomminae) by Wheeler (1907). Otherwise, the biology of the genus remains unknown. Only two species currently are recognized, *I. azteca* from Central America, and *I. coronata* from Brazil (Heraty 2002). One additional species is recognized herein, and the genus occurs over a much broader range in Central and South America.

MATERIALS AND METHODS

The morphology of the species within *Isomeralla* are very similar and the descriptions herein refer only to features that differ or vary within or between species. Terms used in the descriptions of adults follow Heraty (2002), and for planidia, Heraty & Darling (1984). Specimens were imaged using the Auto-montage v. 5.0 digital photography software (Synoptics®) through a Leica M10 Stereomicroscope. Museum depositories include the American Museum of Natural History, New York, New York, U.S.A. (AMNH); California Academy of Sciences, San Francisco, CA, U.S.A. (CAS); Canadian National Collection of Insects, Ottawa, Canada (CNC); Hope Museum, Oxford University, Oxford, England (UMOX); Museo de Zoologica da Universidade de São Paulo, São Paulo, Brazil (DEFS); Museum of Comparative Zoology, Cambridge, MA, U.S.A. (MCZ); Ohio State University, Columbus, OH, U.S.A. (OSU); Purdue University, West Lafayette, IN, U.S.A. (PURC); Royal Ontario Museum, Toronto, ON, Canada (ROME); Texas A&M University, College Station, TX, U.S.A. (TAMU); The Museum of Natural History, London, England (BMNH); University of California, Riverside, CA, U.S.A. (UCRC), and United States National Museum of Natural History, Washington, DC, U.S.A. (USNM).

TAXONOMY

Isomeralla Shipp, 1894

(Figs 1–15)

Isomeralla Shipp, 1894: 188; type species: *Isomeralla coronata* Westwood, by original designation; Dalla Torre 1898: 366 (catalog); Heraty 1995: 313 (in key); 1997: 324 (in key); 2002: 41 (key), 165 (redescription and catalog).

Isomerallia Ashmead, 1899: 240, 242 (in key); 1904: 268, 270 (in key), 471 [misspelling of genus name].

DIAGNOSIS. *Isomeralla* is a distinctive member of the Kapala clade with nipple-shaped eyes and a rounded, bulging frons (Figs 12–15). The scutellar spines are robust, subtriangular in cross section and broadly separated along their length (Figs 7–11).

DESCRIPTION. See Heraty (2002).

PHYLOGENETIC AFFINITIES. *Isomeralla* is placed within a subgroup of the Kapala clade that includes *Kapala*, based on having a distinct propodeal carina surrounding the propodeum and a simple compressed antennal flagellum (Heraty 2002). The swollen gena, deep and narrow scrobal depression, and swollen frons are features shared with *Galearia* Westwood, 1874. As well, both genera have a very short and slender female antenna, and a sculptured scape in males. However, *Galearia* has a sharp genal margin, a single tergal incision on Gt_1 in males, the notauli are much more reduced, and the number and size of the palpi are reduced. *Isomeralla* does not have as well-developed a propodeal carina and lacks the thickened female petiole of *Galearia*. Morphology of a group that includes *Liratella* Girault, 1913, *Isomeralla* and *Galearia* is supported by shallow notauli and a pilose callus; however these are not strong synapomorphies, and alternate relationships with *Dilocantha* Shipp, 1894 are possible (Heraty 2002). Based on 28S and 28S rDNA molecular information, relationships of *Isomeralla* are unresolved in a group with *Kapala* and *Laurella* Heraty, 2002 (Heraty et al. 2004); however, more generic representatives (i.e. *Dilocantha* and *Galearia*) are necessary for accurate resolution within this group. Without an accurately placed outgroup, it is not possible to assign unequivocal polarity to changes within *Isomeralla*, although the dense reticulate puncturing of the head and lower mesosoma are likely shared synapomorphic features of *I. bouceki* sp. nov. and *I. coronata*.

DISTRIBUTION. Neotropical, and associated with lowland rainforest south from northern Mexico (Tamaulipas, Gomez Farias) to eastern Brazil. Three species are recognized.

BIOLOGY AND HOSTS. *Isomeria azteca* has been reared from *Ectatomma tuberculatum* (Olivier, 1791) and *Ectatomma ruidum* (Roger, 1860) (Ectatomminae). Except for the planidium, immatures and oviposition habits are unknown. Specimens have been swept from broad-leaved plants in the understory of a moist forest in Mexico.

Key to species

1. Upper mesepimeron, hind coxa, and vertex lateral to ocelli mostly smooth and shining. *I. azteca* Girault
- Upper mesepimeron and hind coxa finely reticulate and dull, vertex lateral to ocelli finely sculptured. 2
2. Scutellar disc carinate (Fig. 10). *I. bouceki* sp. nov.
- Scutellar disc aciculate (finely scratched) (Fig. 11). *I. coronata* (Westwood)

Isomeria azteca Girault, 1920

(Figs 1, 2, 5, 7–9, 12, 15)

Isomeria azteca Girault, 1920: 203–204. Misspelling of generic name following mistake in Ashmead (1904); Wheeler 1907: 17, figs 58, 59 (host record and illustration of adult); 1910: figs 249a, b (illustration); De Santis, 1979: 107 (catalog); Heraty 1995: fig. 9.9 (in key to genera); 2002: 166, figs 171, 172 (catalog) [illustrations by Wheeler and Heraty mistakenly were referred to as *I. coronata*].

TYPE MATERIAL EXAMINED. “Tampico, Mex [Mexico], 6.12 [lectotype date, other dates vary], E A Schwarz Collector” and “18.4 Cacao, Trece Arguas Alta V. Paz, Guatemala, Schwarz & Barber Coll, *Isomeria azteca* Gir”. Lectotype female designated herein for purposes of nomenclatorial stability (two male and one female paralectotypes from Tampico and one male from Guatemala examined). The lectotype is missing the right antenna and the tip of the other antenna beyond F6. Other Tampico dates are 9.12, 14.12 and 15.12. Type depository: USNM; type no. 20863 (Tampico only).

DIAGNOSIS. Recognized from *Isomeria coronata* and *I. bouceki* sp. nov. by having the genae, upper mesopleuron, hind coxa, and vertex between the ocelli and eyes smooth. The carinae of the scutellar disc occur in three forms: 1) narrowly separated and converging to the midline posteriorly (Fig. 7; as in lectotype and paralectotype males), 2) narrowly separated and parallel (Fig. 8; as in paralectotype female from Tampico), or broadly separated and parallel (Fig. 9).

DESCRIPTION OF FEMALE. Length, 3.2–4.9 mm. Body black; antennae, mouthparts and legs honey yellow; wings hyaline, venation pale brown. Head (Fig. 12) with supraclypeal area and lower face including clypeus transverse aciculate, clypeus mostly smooth or with transverse striae in dorsal half, protuberance of frons evenly micropunctate, gena below eye mostly smooth with scattered micropunctations; vertex smooth lateral to ocelli. Scape expanded subapically, concave just below pedicel with weak ventral carinae, surface smooth. Mesoscutum anterodorsally with abrupt angle of about 90° in profile (Fig. 1) but sometimes broadly rounded (Fig. 2); axillula with parallel evenly spaced carinae, scutellar disc either with weak closely-spaced carinae converging to midline (Fig. 7), less commonly with parallel close or broadly-spaced carinae (Figs 8, 9; see variation), carinae prominent and separated by about 1.0–3.5X their width; posterior margin of scutellar disc abruptly angled to posterior vertical face, posterodorsally with a complete strong transverse carina or only an irregular medial carina; vertical face of scutellum smooth or with a few vertical carinae laterally; scutellar spines with strong linear carinae on lateral and medial face, tip of spine broadly rounded or emarginate with lower margin projecting by its width. Propodeal disc smooth. Lower mesopleuron, metapleuron, fore coxa, and base of mesocoxa evenly and finely reticulate to micropunctate. Upper mesopleuron, hind coxa and central callar area smooth. Fore wing disc and costal cell with dense short setae; stigmal vein about twice as long as broad and perpendicular to wing margin or slightly angled distally; postmarginal vein about as long as stigmal vein.

Male. Length, 3.3–4.2 mm. As in female except as follows: scape dark brown. Head (Fig. 15) with clypeus having scattered weak transverse striae. Antenna with 12 segments, 9 basal flagellomeres each with an alternating (medial or lateral) dorsal branch about equal to head height, apical flagellomere elongate and similar in length to preceding flagellar branch. Scape expanded subapically. Mesoscutum more strongly angled in lateral view (Fig. 5), midlobe with prominent rugae dorsomedially; posterior vertical face of scutellum sometimes rugose. Fore wing disc and costal cell very densely pilose with long hairs.

VARIATION. There is a high degree of variation in the striation of the scutellar disc, which can range from fine parallel striae that dorsally converge to the midline (Fig. 7; lectotype female and most Mexican and Guatemalan specimens), fine parallel carinae (some Mexican and southern Central American specimens), broadly spaced carinae converging to midline (Fig. 8; paralectotype female and a few specimens from Guatemala and Costa Rica), and a few specimens with broadly spaced parallel carinae (Fig. 9; specimens from Chiapas, Costa Rica and Panama). Although these differences are striking in some individuals, and appear to group into northern and southern Central America, the geographic mix of specimens, including the type series, would suggest a single variable species. Across the entire range, most specimens have hyaline (clear) wings. However, a single female from Tamaulipas (fine convergent striate scutellum) and a female likely from Tabago Island in Panama (parallel carinae) have a slightly infuscate fore wing. The female from Tabago Island was originally thought to belong to another species because it has a more broadly rounded mesoscutum, weak dorsal mesosomal striae, and weak transverse striae on the vertical face of the scutellar disc, and sparser discal setation on the fore wing. This specimen is mistakenly labeled as being from Tobago, West Indies, but this likely is a mistake for Tabago Island, Panama (assumption based on a sampling 5 days earlier by Busck in Panama). If the specimen is from Tobago, it may represent a separate species, but if from Panama, and given the variation among other material in Central America, it does not deserve special status.

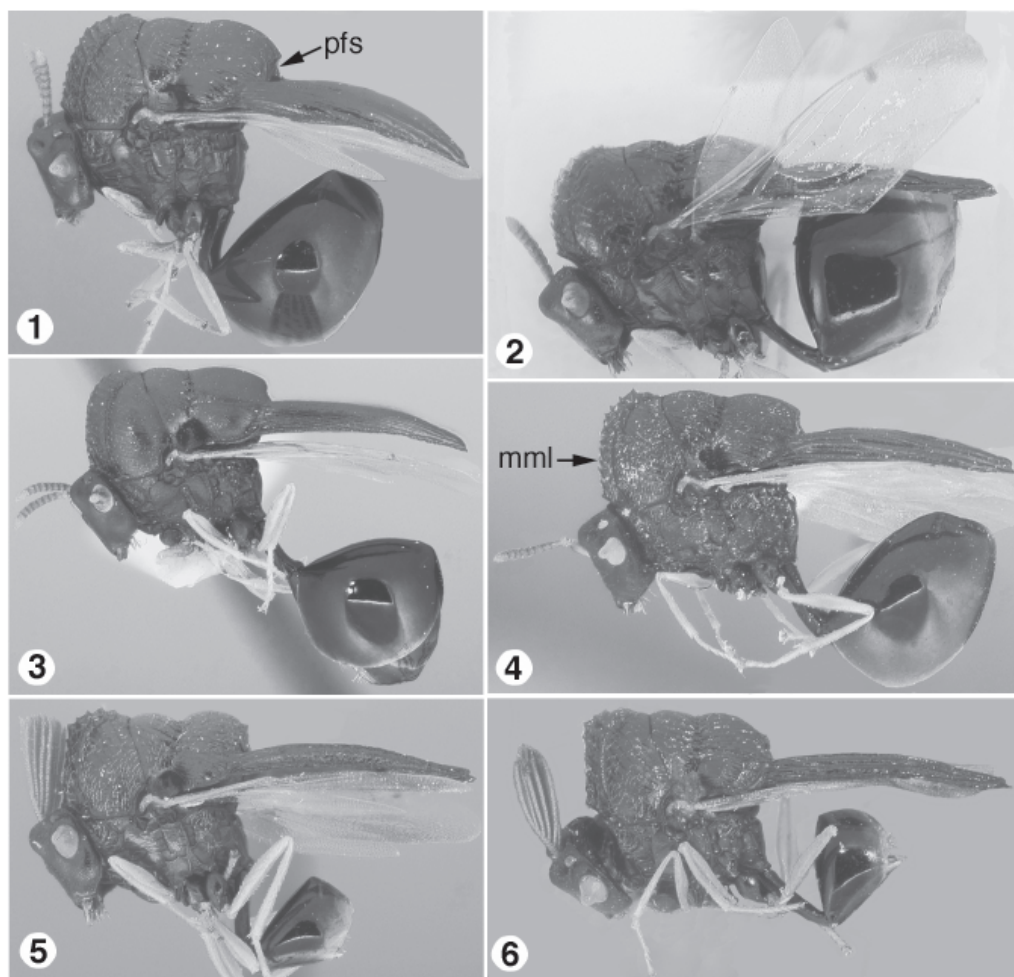
ASSOCIATIONS. Ectatomminae: *Ectatomma tuberculatum* (Wheeler (1907); identification based on illustration); *E. ruidum* (with parallel mesosoma carinae).

IMMATURES. First instar larva (6 planidia attached to an adult female of *I. azteca* from Campeche, Mexico). Morphology and setal pattern are typical of *Kapala* (cf. Heraty & Darling 1984: figs 6, 13): dorsal cranial spines absent; pleurostomal spine present, three pairs of placoid sensilla on cranium; hatchet-shaped sclerite present; tergopleural line (tp) separating pleural and dorsal tergites present on tergites (T) II–IX; tergites (T) I and II fused dorsally and with 4 pairs of setae; TIII with 3 pairs; TV with two pairs, ventral pair stout; TVI with long stout seta dorsal to tergopleural line, as long as TVII–IX; TVII with seta on ventral margin; posterior margins of TIV–TVII ventral to tergopleural line scalloped, with ventral margin prolonged into a long process; TIX entire, not excised medially, but with 2 long projections from ventral margin, each projection as long as TX+TXI; posteroventral margin of TX acuminate; caudal cerci slightly longer than TXI+TXII.

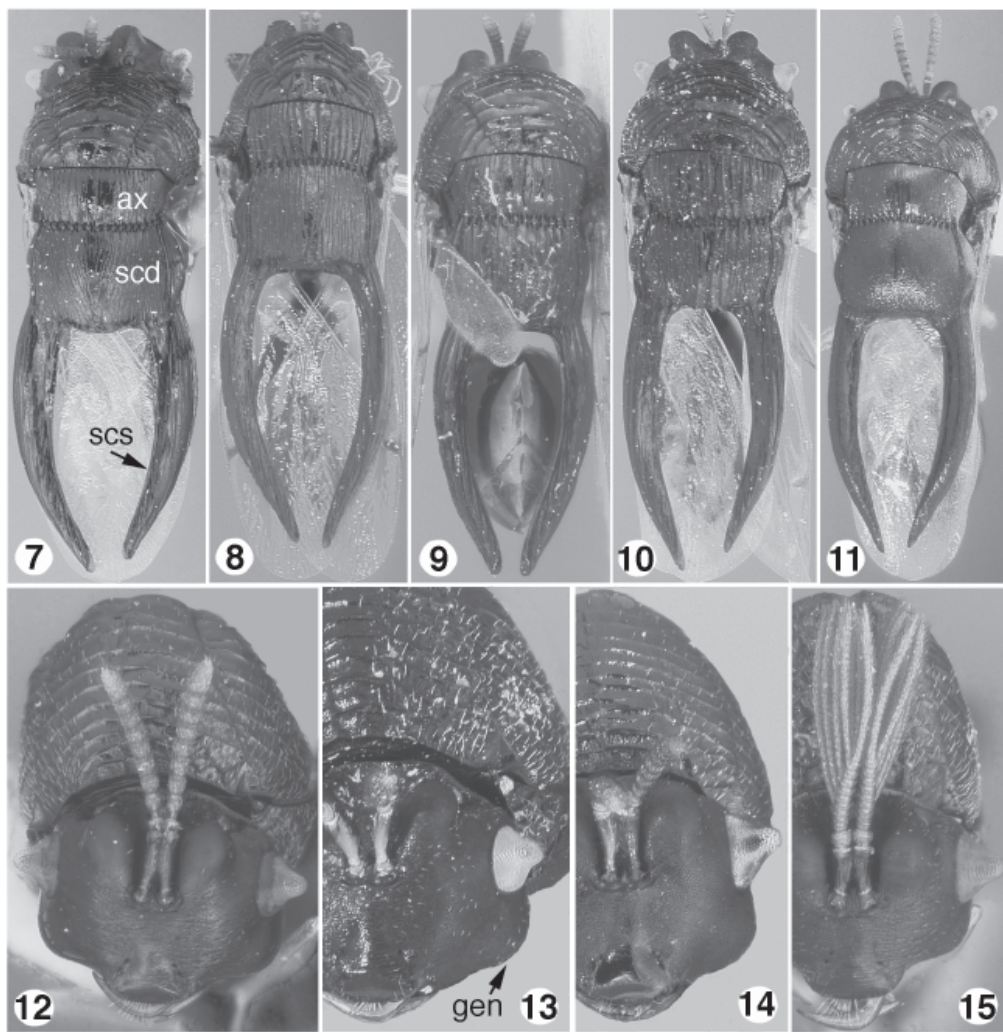
DISTRIBUTION. Central America: Costa Rica, Guatemala (Wheeler 1907), Honduras, Mexico (Wheeler 1907, Girault 1920); Panama.

ADDITIONAL MATERIAL EXAMINED (specimens with dense converging scutellar striate marked with asterisk). **Costa Rica:** Alajuela Arenal, 500m, 28.x.1987, Martin Cooper (2f, MCZ); Puntarenas, Manuel Antonio N.P., 23–28.viii.1986, L. Masner, ss, coastal rainforest (2m, CNC). **Guatemala:** Cayuga, x.1915, Wm Schauss (1f*, USNM); Lanquin, Alta Vera Paz, 1000 ft, 3.vi.1948, CNMH Guatemala Sool. Exped., R.D. Mitchell (1m, OSU). **Honduras, Olanchó:** Culmi, 25.xi.1980, R.W. Jones, carried by *Eciton burchelli* (1m, ROME). **Mexico, Campeche:** Chicana Ruins, 6.5 mi E Xpujil, 13–14.vii.1983, R.S. Anderson (1m*, CNC); 10 km E Xpujil, Chicanna, 300m, 12–14.vii.1983, M. Kaulbars (1 f*, CNC); 8–12 mi. S. Xcabacab, 10.ix.1976, Cate & Clark, on *Hampea trilobata* (3f*, TAMU, 1f with 6 planidia on mesosoma, all slide mounted UCR); 3.8 mi. N Escarcega, 9.x.1976, Cate & Clark (1m*, TAMU); 4 mi E Francisco Escarcega, 23.vii.1983, R. Anderson (3 m*, CNC); 18.5 mi. N Escarcega,

2.viii.1980, Schaffner, Weaver, Freidlander (1f*, TAMU); **Chiapas**: 13 mi NE Cintalapa, 2000', 1.viii.1974, C.W.&L. O'Brien & Marshall (1m, CAS); Munic. Ocozacoatlán, El Aguacero, 1800–2000', 8.viii.1990, J.B. Woolley 90/0550 (1m, TAMU; DNA voucher D#1391); 16 mi SW Comitán, Hwy 190, 30.v.1969, B.V. Peterson (1f*, CNC); Rosario Izapa, 13.ii.1998, G. Pérez, ex. *Ectatomma ruidum* (1f [developed pupa], UCR, DNA voucher D#278); **Tabasco**: Teapa (1f*, BMNH); Teapa, Mach, H.H.S., Godman-Salvin, col. 1904–1 (1f BMNH); **Tamaulipas**: 74 mi S Cd. Victoria (W of Gomez Farias), 15.xi.1985, P. Kovarik, R. Jones and K. Haack (1f*, 2m*, BMNH); 88 km E Cd. Victoria, Sierra de Tamaulipas, 17.xi.1985, P. Kovarik, R. Jones and K. Haack (1m TAMU); 6 mi W Gomez Farias, 5.vii.1986, Schaffner, Kovarik (1m*, TAMU); 6 mi W Gomez Farias, 6–7.vii.1986, Schaffner (1m*, TAMU); [6 mi W] Gomez Farias, 25.vii.1987, J.M. Heraty 8722000 (1f*, 1m*, UCR, TAMU; both DNA vouchers D#1417); **Veracruz**: Pueblo Viejo, 8.xii.1909, F.C. Bishopp (1f*, USNM);



Figs 1–6. Lateral habitus. 1 – *Isomerula azteca* Girault (female, Mexico); 2 – *I. azteca* (female, Panama); 3 – *I. coronata* (Westwood) (female); 4 – *I. bouceki* sp. nov. (female); 5 – *I. azteca* (male); 6 – *I. bouceki* sp. nov. (male); mml = mesoscutal midlobe, pfs = posterior vertical face of scutellum.



Figs 7–15. 7–11 head and mesosoma, dorsal view (female): 7 – *Isomerula azteca* Girault (Mexico); 8 – *I. azteca* (Costa Rica); 9 – *I. azteca* (Panama); 10 – *I. bouceki* sp. nov.; 11 – *I. coronata* (Westwood). 12–15 head in anterior view: 12 – *I. azteca* (female, Mexico); 13 – *I. bouceki* sp. nov. (female); 14 – *I. coronata* (female); 15 – *I. azteca* (male); ax = axilla, gen = gena, scd = scutellar disc, scs = scutellar spines.

Yucatan: between Kinchill and Celestun, viii–xi.1983, R. Fisher (1f*, TAMU); El Edén, viii.1998, M. Gates, sweep of secondary vegetation along road (1f*, UCR; DNA voucher D# 364). **Panama:** Ancon, 6.viii.1924, #845 (1f, MCZ); Taboga Island, 21–22.ix.1918, H.S. Diets (1f, 1m, USNM); Taboga Island, xii.1946, N.H.L. Krauss (1m, USNM); Taboga Island [=Tobago, W.I. on label, likely an error based on having the following specimen collected 5 days earlier], 23.ii.1912, A. Busck (1f, USNM); Tabogilla Island, 18.ii.1912, A. Busck (1m, UCR).

Isomerula bouceki sp. nov.

(Figs 4, 6, 10, 13)

TYPE MATERIAL. Holotype f. "Moericke Trap w yellow bottle – Santa Margarita Circ. Rd., Curepe, Trinidad, May 26 – June 8 1974, F.D. Bennett" "automontage # istr-01", deposited in CNC. Paratypes. **Trinidad:** Trinidad I., 27.i.1962, H.D. Chipman (1f, PURC); St. Augustine, 17.viii.1944, I.E. Kirby, on *Cordia* (1f, UCR); Mt. St. Benedict, 11.vii.1953 (1f, CNC); Victoria, Hardbargain, 18.vii.1976, J.S. Noyes, BM 1976-462, scrubland (1f, BMNH). **Venezuela, Distrito Federal:** Caracas, 500m, 30.ix.1967, J. & B. Bechyne (1f, BMNH); **Cojedes:** El Baul, 21.vii.1967, J. & B. Bechyne (1m, BMNH; imaged).

ETYMOLOGY. Named in honour of Zdeněk Bouček for his accomplishments in the taxonomy of Eucharitidae, and in celebration of his 80th birthday.

DIAGNOSIS. Recognized by the combination of a linearly carinate scutellum, axillula and scutellar spines, finely reticulate mesepimeron and coxae, and fore wing disc with only very short scattered setae.

DESCRIPTION OF FEMALE. Length, 4.1–5.2 mm. Body black; antennae brown; mouthparts brown to honey yellow; legs honey yellow with femora the same or light to dark brown medially; wings hyaline, venation brown. Head (Fig. 13) with supraclypeal area and lower face including clypeus finely strigate with elongate-reticulate subsculpture, ventral half of clypeus weakly carinate, gena below eye and protuberance of frons evenly micropunctate; vertex finely reticulate. Scape subapically expanded and concave just below pedicel with ventral carinae, surface finely sculptured. Mesoscutum anterodorsally with abrupt angle of about 90° in profile (Fig. 4); scutellum and axillula with parallel evenly spaced carinae, the carinae prominent and separated by about 2.5–3X their width (Fig. 10); posterior margin of scutellar disc abruptly angled to posterior vertical face, without transverse carina, and longitudinal carinae continuing onto vertical face; scutellar spines with strong linear carinae on lateral face and weak carinae on medial face, tip of spine emarginate with lower margin projecting by more than its width. Propodeal disc with very weak reticulate surface sculpture, nearly smooth. Mesopleuron, metapleuron, callus, and coxae evenly and finely reticulate to micropunctate. Fore wing disc with very short scattered setae, costal cell with sparse hairs basally; stigmal vein about twice as long as broad and perpendicular to wing margin or slightly angled to apex of wing; postmarginal vein less than half as long as stigmal vein.

Male. Length, 4.2 mm. As in female except as follows: scape dark brown, legs uniformly honey yellow. Antenna with 9 basal flagellomeres, each with an alternating (medial or lateral) dorsal branch about equal to head height, apical flagellomere elongate and similar in length to preceeding flagellar branch. Scape strongly expanded subapically and concave with median ventral carinae just below pedicel. Mesoscutum more strongly angled in lateral view (Fig. 6), midlobe with prominent transverse rugae dorsomedially. Posterior margin of scutellar disc abruptly angled to vertical face with strong irregular transverse carina medially, longitudinal carinae continuing onto vertical face laterally. Fore wing disc and costal cell densely pilose with long hairs.

VARIATION. One female from Maracas (Trinidad) has the antennae dark brown to black. A female from Ancon (Panama) has lighter colored antennae and mouthparts (honey yellow) and the scutellar disc striae are fine, closely spaced and converging to the midline as in *I. azteca*; however, all other features correspond with typical *I. bouceki* sp. nov. A single small (2.9 mm) male from Colombia is similar to the male from Venezuela, but has dark brown to black antennae, a smooth patch on the gena just below the eye, most of the hind coxa smooth, and the dorsal aspect of the mesosoma not as pronounced. A small female (2.9 mm) from Monteliro (Panama) is almost an exact match for this male. These specimens likely represent a separate species, but its description is not warranted at this time, especially as the variation may be correlated with the small specimen size.

DISTRIBUTION. South America (Colombia? Panama? Trinidad, Venezuela).

ADDITIONAL MATERIAL. **Colombia:** Vichada, PNN, Tuparro Cerro Tomás, 140m, 5°21'00"N 67°51'38"W, 18–28.viii.2000, W. Villalba (1m, UCR). **Panama:** Ancon, 6.vi.1924, #825 (1f, MCZ); Monteliro, 27.viii.1923, R.C. Shannon (1f, USNM).

***Isomerala coronata* (Westwood, 1874)**
(Figs 3, 11, 14)

Thoracantha coronata Westwood, 1874: 154, plate 28, fig. 10; Ashmead 1904: 471 (catalog); Heraty 2002: 166 (catalog).

Isomerala coronata: Shipp 1894: 188 (change of combination); Dalla Torre 1898: 366 (catalog); Ashmead 1904: 471 (catalog); De Santis 1980: 211 (catalog); Heraty 2002: 166 (catalog).

TYPE MATERIAL EXAMINED. "Parasite found near mouth, Bahia Higgins 1867". Lectotype female designated by Heraty (2002). Type depository: UMOX; type no. 680. The specimen from Amazonia [Amazonia] is lost. Heraty (2002) mistakenly attributed 'Bahia' as from Mexico and not Brazil, of which the latter is correct.

DIAGNOSIS. This is the only species with an aciculate (appearing finely scratched) scutellar disc, and with the scutellar spines laterally with very fine longitudinal striae.

DESCRIPTION OF FEMALE. Length, 4.3–4.7 mm. Body black; antennae brown; mouthparts pale brown; legs honey yellow; wings hyaline, venation pale brown to indistinct. Head (Fig. 14) with supraclypeal area and adjacent lower face micropunctate, clypeus mostly smooth and shining, protuberance of frons evenly micropunctate, with punctures smaller and denser than rest of face, gena below eye and vertex micropunctate. Scape just below pedicel subapically expanded and concave with weak lateral carinae, surface weakly sculptured. Mesoscutum anterodorsally rounded in profile, but with anterior face angled about 90° to dorsum (Fig. 3); scutellar disc and axillula aciculate (Fig. 11); posterior margin of scutellar disc evenly angled to vertical face and without transverse carina, medially disc with weak longitudinal sulcus that becomes more prominent apically, few longitudinal striae continuing onto vertical face dorsally, otherwise with posterior vertical face mostly smooth or aciculate; scutellar spines with fine linear striae on lateral face and weak carinae on medial face, tip of spine narrowly emarginate medially with lower margin not projecting. Propodeal disc smooth. Mesopleuron, callus, metapleuron, and coxae evenly and finely reticulate to micropunctate, but mesepimeron with weaker sculpture. Fore wing disc with very short setae (microtrichea) but with setae longer basally, costal cell with sparse hairs basally; stigmal vein about twice as long as broad and slightly angled to base of wing; postmarginal vein about twice as long as stigmal vein.

Male. Unknown.

DISTRIBUTION. Brazil (eastern) (Westwood 1874, De Santis 1980).

ADDITIONAL MATERIAL EXAMINED. **Brazil, Distrito Federal:** x.'81, K. Klette, Hym. Inv. Nm. 31, xi.iv.6 (1f BMNH); **Espírito Santo:** Linhares, ix.1972, M. Alvarenga (1f, CNC; imaged); Linhares, Sooretama (1f, AMNH); **Para:** Belem, 26.i.1969, L. & C.W. O'Brien (1f, AMNH); **Pernambuco:** Jabatão, vii.1955 (3f on one card, DEFS); **Rio de Janeiro:** Nictheroy, 25.viii.1923, G.L.R. Hancock (1f, BMNH).

A c k n o w l e d g e m e n t s

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APPENDIX

Corrections and nomenclatorial changes

Hymenoptera: Chalcidoidea: Eucharitidae:

(1) ***Mimistaka* nom. nov.**

Risbecia Heraty, 2002: 231; type species *Risbecia unispina* Heraty, 2002, preoccupied by *Risbecia* Odnher, 1934 (Nudibranchia: Eudoridoidea).

ETYMOLOGY. A latinized random combination of letters referring to the error in naming.

(2) *Mimistaka unispina* (Heraty, 2002); **comb. nov.**

(3) *Pseudochalcura excruciatata* Heraty (1986: 191–193) is the correct name; spelled as *P. excruciatata* in the abstract and key, but *P. excruciatata* in the header for the species description.

(4) Holotype of *Dilocantha bennetti* Heraty, 1998 is in the MCZ, not BMNH (cited in Heraty 2002).

(5) Fig. 81 (Heraty 2002) is *Chalcura ramosa* (Girault, 1940), not *C. samoana* Fullaway, 1940.

A first review of the Coelocybinae of the New World (Hymenoptera: Pteromalidae)

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Abstract. The South and Central American fauna of the Coelocybinae is reviewed. The genus *Lanthanomyia* De Santis, 1967, with its only described species *L. australis* De Santis, 1967, is transferred into the Coelocybinae, and five new species are described: *L. bouceki* Heydon, sp. nov., *L. compacta* Heydon, sp. nov., *L. pumita* Heydon, sp. nov., *L. soonae* Heydon, sp. nov., and *L. tigrata* Heydon, sp. nov. Two new genera are described: *Ambogaster* Heydon, gen. nov., with the included species *A. colyma* Heydon, sp. nov. and *A. wibawae* Heydon, sp. nov. and *Cecidellis* Hanson, gen. nov., with the included species *C. inflativena* Hanson, sp. nov., *C. nectandra* Hanson, sp. nov. and *C. nigriseta* Hanson, sp. nov. A key is given to the genera and species treated. The biologies of species of Coelocybinae are reviewed. Species of *Ambogaster* gen. nov. and *Lanthanomyia* gen. nov. are associated with galls on *Nothophagus*. Species of *Cecidellis* are associated with galls on various plants and at least one species is a solitary ectoparasitic idiobiont.

Taxonomy, gall, new genus, new species, distribution, Hymenoptera, Chalcidoidea, Pteromalidae, Nothophagus, Cecidomyiidae, Philodendron, Chile, Costa Rica, Neotropical region

INTRODUCTION

The Pteromalidae is one of the most problematic families of Chalcidoidea and is widely recognized as an artificial group. This family is characterized primarily by the lack of features used in defining the other chalcidoid families. Perhaps one of the best ways to remedy this situation is to examine in greater detail each of the 31 currently recognized subfamilies (Noyes 2002).

In this paper we treat the known New World members of Coelocybinae, a subfamily created by Bouček (1988) to include 14 genera from Australia and New Zealand. Bouček mentioned that an undescribed genus of Coelocybinae occurs in South America, but no further work on the New World members of this subfamily was done. Studies of the collection of the Museo Argentino de Ciencias Naturales in Buenos Aires revealed that the “undescribed” genus had already been described as *Lanthanomyia* De Santis, 1967. Based on collecting trips to southern South America and examination of museum specimens by the first author, and extensive rearing of parasitoids from plant galls in Costa Rica by the second author, two undescribed genera and numerous undescribed species have been found. More new species undoubtedly remain to be found, but hopefully the present study will encourage further work on the New World fauna of Coelocybinae. The new information presented here suggests that this subfamily, like certain other hymenopteran taxa (e.g. labenine ichneumonids and thynnine tiphiids), has a primarily gondwanic distribution, but with a radiation into tropical America.

One of the new genera described below will not go to Coelocybinae in the key to Australasian Pteromalidae (Bouček 1988) because it has a reduced number of antennal segments. The subfamily is not included in the key to Nearctic Pteromalidae (Bouček & Heydon 1997) since it does not occur there. However, the New World members of this subfamily can be distinguished from other Pteromalidae by the following combination of characteristics: body length 6 mm or less, from pale yellow to black (never metallic), inner margins of eyes diverging ventrally (as in Cleonyminae), scutellum usually with a finely impressed frenal line and one or two lateral pairs of long erect bristles (one pair on each side of the frenal line), and the first tergum of metasoma not enlarged.

Where the biology is known, larvae of Coelocybinae always occur in plant galls and are associated with a diversity of gall-inducing insects. In Australia and New Zealand *Acoelocyba* Bouček, 1988 is associated with galls of *Apion* Herbst, 1797 (Coleoptera: Curculionidae), *Coelocyba* Ashmead, 1900 with galls of Melanosomellini (Pteromalidae: Ormocerinae) and Fergusoniidae (Diptera), *Coelocyboides* Girault, 1913 with galls of Eriococcidae (Hemiptera: Coccoidea), and *Fusiterga* Bouček, 1988 with galls of Cecidomyiidae (Diptera) (Bouček 1988). Some are thought to be parasitoids, but *Coelocyba nigrocincta* Ashmead, 1900 develops as an inquiline in the galls of *Perilampella hecataeus* (Walker, 1839) (Melanosomellini) on *Acacia decurrens* (Wendl.) Willd. (Fabaceae) (Noble 1941).

New World Coelocybinae also seem to be strictly associated with plant galls. Specimens of *Cecidellis* Hanson, gen. nov. have been reared from a diversity of cecidomyiid galls (Table 1) as well as from a braconid gall on *Philodendron* (Araceae). Dissections of the latter galls suggest that they are solitary ectoparasitoids of the gall-inducer and cause a permanent paralysis in the host. While *Cecidellis* is widely distributed in the Neotropical region, the other two genera, *Ambogaster* Heydon n. gen. and *Lanthanomyia*, appear to be restricted to *Nothofagus* (Nothofagaceae) forests in southern Chile and southwestern Argentina. Label data on a series of *L. australis* De Santis, 1967 from the Natural History Museum in London suggests that this species is associated with *Apion* galls on *Nothofagus antarctica* (G. Forster) Oersted and *N. pumilo* (Poep. et Endl.) Krasser. In New Zealand an undescribed species of *Acoelocyba* is associated with same genus of weevil and the same genus of host plant (Bouček 1988). It is quite likely that the South American *Nothofagus* galls are in fact induced by Melanosomellini (*Aditrochus gnirensis* Fidalgo, 1993 on *N. antarctica* and *A. fagicolus* Rübsaamen, 1902 on *N. pumilo*), and that the weevils are inquilines (De Santis *et al.* 1993). The second author has observed galls apparently induced by *Aditrochus coihuensis* Ovruski, 1993 on *Nothofagus dombeyi* (Mirbel) Oersted in Chile, which contained both weevil and cynipid (*Paraulax* Kieffer, 1904) inquilines. *Lanthanomyia* is almost certainly not the gall-inducer, but its exact trophic relationship within these galls remains unknown. Careful dissections are still needed to determine the roles of all the participants in these gall communities.

MATERIALS AND METHODS

Terminology generally follows that of Gibson *et al.* (1997) except club is used instead of clava, the fine setae that cover the body generally are called the microsetae, and the one pair of large black macrosetae on the scutellum are called bristles. The following abbreviations are used: the median ocellar diameter is MOD, the ocellar-ocular distance is OOL, the posterior ocellar distance is POL, the lateral ocellar distance is LOL, the multiporous plate sensilla are MPP sensilla, the lower ocular line is LOcL, the antennal funicular segments are F1 through F6, and the gastral terga are T1–T7 with T1 being the first tergite after the petiole. The measurements given in the descriptions can be converted to millimeters by multiplying by 0.02.

The acronyms for the collections where specimens are deposited is as follows: BMNH, The Natural History Museum, London, United Kingdom; CASC, California Academy of Sciences, San Francisco, USA; CNC, Canadian National Collection, Ottawa, Canada; INBio, Instituto Nacional de Biodiversidad, Santo Domingo, Costa Rica;

MLPA, Museo de La Plata, Universidad Nacional de La Plata, La Plata, Argentina; MNNC, Colección Nacional de Insectos, Museo Nacional de Historia Natural, Santiago, Chile; MUCR, Museo de Insectos, Universidad de Costa Rica, San Pedro, Costa Rica; UCDC, Bohart Museum, University of California, Davis, USA.

TAXONOMY

Key to New World Species of Coelocybinae

1. Funicle with only 4 segments (Fig. 1); vertex with sparse coarse erect white to black setae (Figs 15, 16); petiole with broad transparent dorsal lamina which arches forward and covers nuchal region of propodeum (Figs 2, 16). Tropical South and Central America. *Cecidellis* Hanson, gen. nov. ... 2
 - Funicle with 6–7 large segments with MPP sensilla (Figs 4, 8, 10, 21, 22); vertex with setae numerous, short and subappressed; petiole unmodified dorsally (Figs 5, 6). From Chile and Argentina. 4
2. Face usually whitish, gastral tergites without transverse dark bands; setae of head and mesosoma white to pale gray. Male with submarginal vein lenticularly thickened (Fig. 11). *C. inflativena* Hanson, sp. nov.
 - Face yellow (like rest of body), basal tergites of gaster with transverse dark bands (Fig. 16); setae of head and mesoscutum predominantly black. Male with submarginal vein slender, but sometimes with parastigma greatly thickened (Figs 12, 14). 3
3. Scutellum with 2 longitudinal rows of erect setae; speculum of fore wing mostly bare; ovipositor exerted less than 1/2 hind tibial length. Male with parastigma greatly enlarged (Fig. 12). *C. nectandra* Hanson, sp. nov.
 - Scutellum with 4 or 6 longitudinal rows (often arranged irregularly and rows not evident); speculum with at least one row (usually more) of setae; ovipositor exerted more than 1/2 hind tibial length. Male with parastigma not enlarged (Fig. 14). *C. nigriseta* Hanson, sp. nov.
4. T1 with anterior median edge carinate (Fig. 6); the dorsal surface behind the carina with rows of elongate pits (Fig. 6). Hind coxa smooth to reticulate–rugose (Fig. 6). *Ambogaster* Heydon gen. nov. ... 5
 - T1 with anterior edge rounded (Fig. 5); its dorsal surface smooth or with reticulate sculpturing. Hind coxa densely covered with elongate pits that form ovate “finger print” pattern on its lateral side (Fig. 5). *Lanthanomyia* De Santis ... 6
5. Scape cylindrical (Fig. 8). Malar distance 1/2 eye height (Fig. 7). Propodeum with irregular subparallel grooves like those on the basodorsal surface of Gt₁. Dorsellum reticulate and weakly convex along midline. *A. cohyma* Heydon, sp. nov.
 - Scape flattened, anterior edge sharply carinate (Fig. 10). Malar distance about 3/4 eye height (Fig. 9). Propodeum with reticulate–rugose sculpture over most of its surface that differs from the sculpturing on Gt₁ (Fig. 6). Dorsellum smooth and weakly concave along midline. *A. wibawae* Heydon, sp. nov.
6. Microsetae of body pale in contrast to stronger black bristles on scutellum and at wing base (color of setae easiest to determine on lateral parts of scutellum). 7
 - Both microsetae and scutellar bristles black. 8
7. Eye small round and bulging; eye height only 1.2–1.3× malar distance (Fig. 17). Females with gaster lanceolate; its length 1.4–1.6× the combined length of the head and mesosoma. Males with pleura yellowish. *L. australis* De Santis
 - Eye larger, ovate and less bulging; eye height 1.6–1.8× malar distance (Fig. 19). Females with gaster ovate acuminate; its length only 1.0–1.2× combined length of head and mesosoma. Males with black coloration covering most of pleural region. *L. bouceki* Heydon, sp. nov.
8. Scape nearly cylindrical, anterior edge rounded (Figs 21, 22). Metapleuron smooth. 9
 - Scape flattened, anterior edge sharply carinate along entire length (Figs 25, 26). Metapleuron usually with weak coriaceous sculpturing. 10
9. Gaster lanceolate, distinctly longer than combined length of head and thorax (Fig. 18). Forewing with basal cell with short glabrous band anterior to line of setae down cubital vein (Fig. 23). Antenna with anellus and basal 4 funicular segments elongate (Fig. 22). Species large, body length >4 mm. *L. soonae* Heydon, sp. nov.
 - Gaster ovate acuminate, shorter than combined length of head and thorax. Forewing with basal cell completely setose. Antenna with anellus and all funicular segments quadrate or transverse (Fig. 21). Species small, body length <2 mm. *L. compacta* Heydon, sp. nov.
10. Scape strongly flattened, scape only about 3.5× as long as wide (Fig. 25). Pronotum amber colored, with median smooth area small and not reaching to top of collar. Eye ovate (Fig. 24). *L. pumita* Heydon, sp. nov.
 - Scape not as strongly flattened, scape about 4× as long as wide (Fig. 27). Pronotum with collar black and neck yellow; with median smooth area long, reaching to yellow color. Eye with lower margin curving more strongly than upper margin and coming almost to a blunt point (Fig. 26). *L. tigrita* Heydon, sp. nov.

***Ambogaster* Heydon, gen. nov.**

TYPE SPECIES. *Ambogaster wibawae* Heydon, sp. nov.

DESCRIPTION. Color. Body yellowish brown to dark brown, non-metallic; wings without colored maculae or bands. Antenna (Figs 8, 10) with basal 2 segments of flagellum elongate, but without MPP sensilla; with six funicular segments. Mesosoma with long sloping pronotum; complete notauli; scutellum with two pairs of black bristles (the anterior pair may be reduced in small specimens); propodeum distinctly more than half as long as scutellum, without basal crescentic cup; pleural regions smooth. Hind coxa with dorsal row of hairs over apical 2/3; sculpturing varying from irregular longitudinal impressed lines to irregular reticulations. Wings with dorsal surface completely or almost completely covered with setae. Gaster with T1 with basal transverse carina (Fig. 6); with rows of deep elongate pits behind this carina; all tergites separate. The habitus is similar to that shown in Fig. 3.

DIAGNOSIS. The combination of the elongate anelli, the complete notauli, the two pairs of scutellar bristles, and the gastral T1 with a baso-dorsal carina and elongate sub-parallel grooves uniquely distinguish this genus. There may be other characters since only a limited number of the Australian coelocybine genera were examined, but the carina and the elongate pits on Gt₁ are distinct apomorphic characters that serve to define this genus. A key to separate the two described species is found at the beginning of this paper.

ETYMOLOGY. The generic name is derived from the Greek words *ambon*, meaning ridge or crest, and *gaster*, meaning stomach or belly. The gender is feminine.

BIOLOGY. The biologies of species of *Ambogaster* Heydon, gen. nov. are unknown but specimens of *A. wibawae* Heydon, sp. nov. have been collected off *Berberis* and *Nothophagus antarctica*. Related genera are associated with gall-forming insects and the biology of *Ambogaster* Heydon, gen. nov. species may be similar.

***Ambogaster colyma* Heydon, sp. nov.**

(Figs 6–8)

TYPE MATERIAL. The holotype female (MNNC) was collected at Laguna Posada, Región VIII, CHILE on 16.VII.1995 by T. Cekalovic (TC-453).

DESCRIPTION. Holotype, female. Color. Body dark brown except face, ventral 1/2 of gena pale yellow and most of mesoscutum, axilla, axillula, prepectus brownish yellow. Antenna with scape brownish yellow but turning brown at apex; remainder brown except pedicel with ventroapical 1/2 brownish yellow. Legs brownish yellow except hind coxa brown dorsally. Wings hyaline; veins pale yellow-brown.

Sculpture. Frenum coriaceous; dorsellum weakly reticulate; propodeum with irregular subparallel grooves like Gt₁, without median carina; metapleuron smooth.

Structure. Body length 2.3 mm. Head (Fig. 7) width 1.3× height (28:21), 1.9× length (28:15); eye height 1.0× length (13.0:12.5), 2.2× malar distance (13:6), length 8.3× temple length (12.5:1.5); relative lengths of MOD, OOL, POL, LOL as 2.0:4.5:6.5:3.5. Antenna (Fig. 8) with length of pedicel plus flagellum 1.2× head width (34:28); relative lengths of scape, pedicel, anelli 1–2, F1–6, club as 13.0:6.5:4.5:3.0:3.0:2.5:2.5:6.5; relative lengths of F1, F6, club as 2.0:2.5:2.5; scape cylindrical, length 6.5× maximum width (13:2). Mesosoma length 2.2× width (48.5:22.0); dorsellum weakly convex; propodeum lacking any hairs between the postspiracular sulci. Forewing length 3.0× width (101:34); relative lengths of submarginal, marginal, postmarginal, stigmal veins as 40:18:20:10. Gaster length 2.3× width (61:26); 1.1× combined length of head and mesosoma (61:57); Gt₁ extending 0.23× gaster length (14:61).

Male. Unknown.

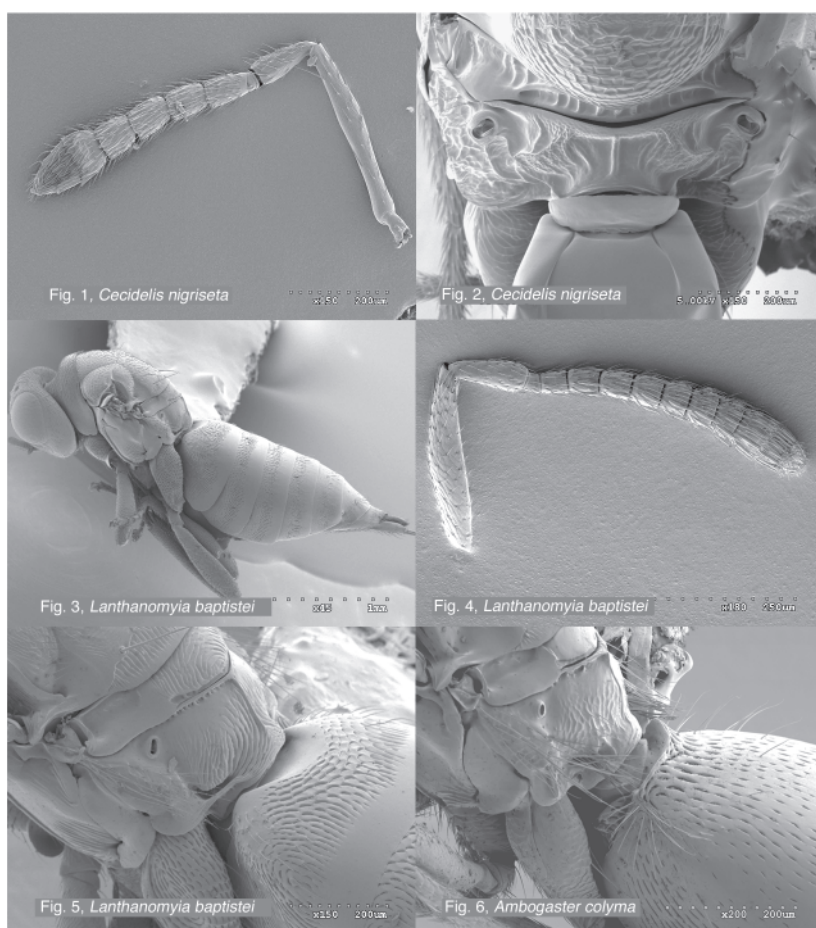
ETYMOLOGY. The species epithet, from the Greek noun *kolyma*, meaning hindrance or impediment, refers to the fact that this paper was nearly finished when I found the specimen belonging to this species.

BIOLOGY. Nothing is known of the host(s) of *Ambogaster colyma* Heydon, sp. nov.

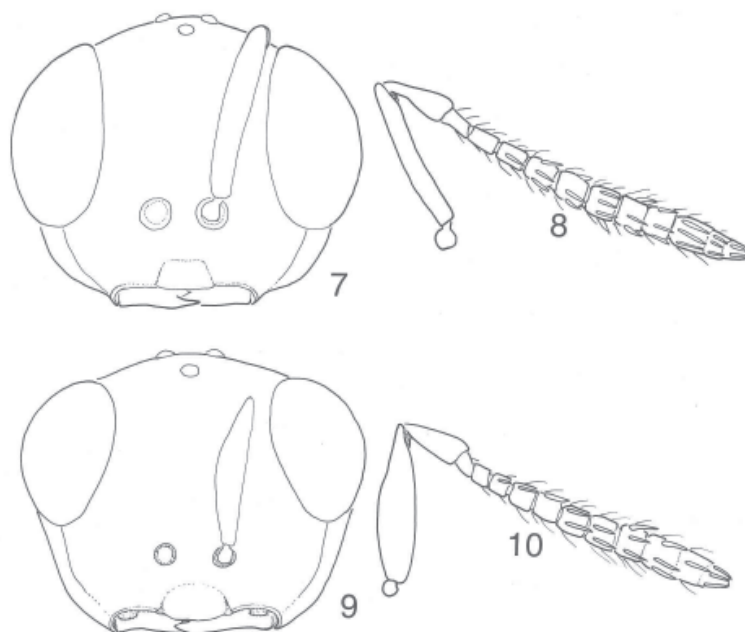
***Ambogaster wibawae* Heydon, sp. nov.**

(Figs 9–10)

TYPE MATERIAL. The holotype female (MNNC) is from Shangri-lá (near Termas de Chillán), VIII Región, CHILE and was collected on 15.III.1993 by J. E. Barriga from *Berberis* sp. The allotype male and one paratype male are from Hullay Bajo, Isla Quinchao, Región X, CHILE and were collected on 17.II.1995 by T. Cekalovic. Twelve other paratypes were collected as follows (MNNC, UCDC): ARGENTINA. Neuquén, Parque Nacional Lanin, 2km nw.



Figs 1–6. 1, 2 – *Cecidellis nigriseta* Hanson, sp. nov., female; 1 – antenna, 2 – propodeum. 3–5 – *Lanthanomyia bouceki* Heydon, sp. nov., female; 3 – whole body, 4 – antenna, 5 – propodeum and base of gaster. 6 – *Ambogaster colyma* Heydon, sp. nov., female, propodeum and base of gaster.



Figs 7–10. *Ambogaster* Heydon, gen. nov. species, female. 7, 8 – *A. colyma* Heydon, sp. nov.; 7, head, anterior view, 8 – antenna. 9, 10 – *A. wibawae* Heydon, sp. nov., female; 9 – head, anterior view, 10 – antenna.

Nonthué (40°08'S 71°38'W), 20–24.II.1999, MT, 1♀. CHILE. X Región: Piol-pid, 14.II.1996, 1♀. Isla Chiloé, Chepu, 12.II.1994, 1♂, road to Melleico, 18.II.1995, 1♂; Puente La Caldera, 15.II.1995, 1♀; Vilupulli, 14.II.1996, 1♀. Isla Lemuy, Aldachildo, 20.II.1996, 2♀, Puerto Haro, 20.II.1996, 1♂. XII Región: Río Grey, 16.II.1996 (off *Nothofagus antarcticus*), 1♀, 1♂; Silla del Diablo, 15.II.1990, 1♀.

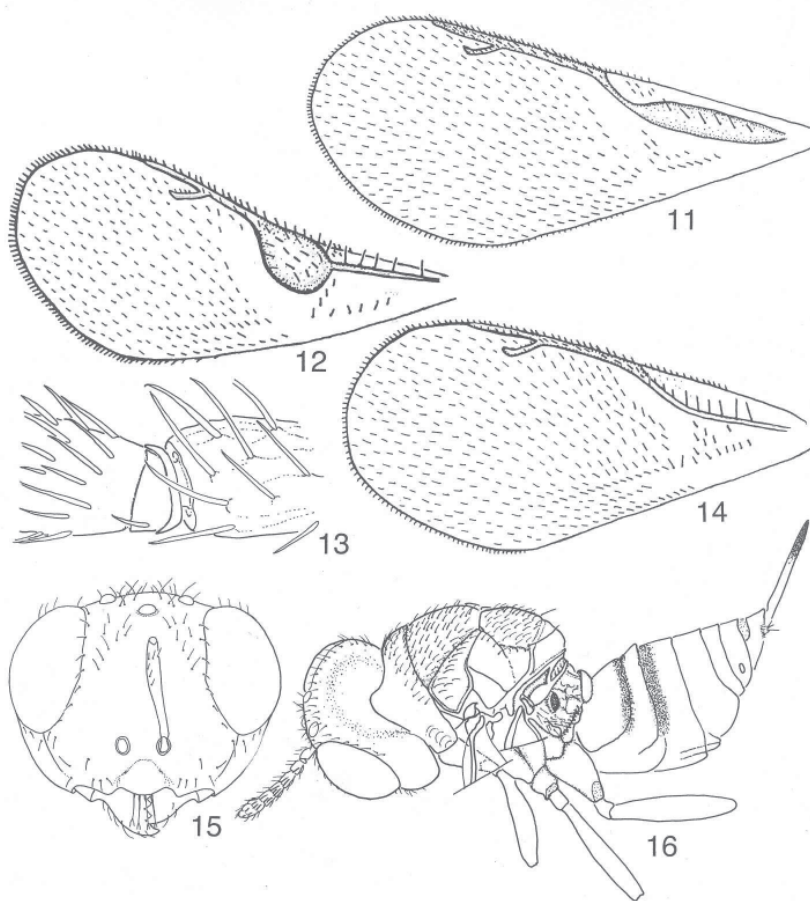
DESCRIPTION. Holotype, female. Color. Head brownish yellow, vertex brown; mesosoma yellow brown with median area of pronotum and entire scutellum, dorsellum, propodeum brown; gaster brownish black. Antenna with scape brownish yellow, remainder brown. Legs yellow brown. Wings with weak yellow cast; veins yellow brown, submarginal vein slightly darker. Microsetae pale.

Sculpture. Frenum coriaceous, dorsellum smooth; propodeum smooth along anterior edge, reticulate-striate over remainder, propodeum with median carina; metapleuron smooth.

Structure. Body length 2.8 mm. Head (Fig. 9) width $1.2 \times$ height (35.0:28.5); $1.9 \times$ length (35:18); eye height $1.0 \times$ length (16:16), $1.3 \times$ malar distance (16:12), length $8.0 \times$ temple length (16:2); relative lengths of MOD, OOL, POL, LOL as 2.0:4.5:8.0:5.0. Antenna (Fig. 10) with length of pedicel plus flagellum $1.0 \times$ head width (36:35); relative lengths of scape, pedicel, anelli 1–2, F1–6, club as 14.0:6.0:1.5:3.0:3.0:3.0:3.0:3.0:3.0:10.0; widths of F1, F7, club as 2.3:3; scape flattened with anterior edge carinate, length $4.0 \times$ width (14.0:3.5). Mesosoma length $1.9 \times$ width (56:30); dorsellum weakly concave; propodeum with patch of white hairs in posterior half of median panels. Forewing length $2.7 \times$ width (122:45); relative lengths of submarginal, marginal, postmarginal, stigmal veins as 50:16:28:15. Gaster length $2.3 \times$ width (70:30), $1.1 \times$ combined length of head and mesosoma (70:66); Gt₁ extending $0.37 \times$ gastral length (26:70).

Allotype, male. Similar holotype above except entire mesosoma yellow brown; wings hyaline, all veins yellow brown. Body length 1.8 mm. Antenna with length of pedicel plus flagellum $1.0\times$ head width (25.0:25.5); scape broadened and flattened, length only $3.1\times$ width (11.0:3.5); relative lengths of scape, pedicel, anelli 1–2, F1–6, club as 11.0:5.0:1.0:2.0:2.0:2.0:2.0:2.5:2.5:2.0:6.0; relative widths of F1, F7, club as 1.0:2.5:2.5; club with ovate terminal patch of micropilosity on the end of the club.

VARIATION. *Ambogaster wibawae* Heydon, sp. nov. as defined herein, may be an extremely variable species. The body size for females varies from 1.9–3.0 mm. The specimens listed below as type material are relatively constant in size and color. The smaller specimens, those listed as additional material in the Specimens Examined section of this paper, tend to be much darker than the larger ones, with the body almost completely dark brown in some specimens. These small specimens also



Figs 11–16. *Cecidellis* Hanson, gen. nov. species. 11 – *C. inflativena* Hanson, sp. nov., male, fore wing. 12 – *C. nectandra* Hanson, sp. nov., male, fore wing. 13–16 – *C. nigriseta* Hanson, sp. nov.; 13 – detail of anelli, drawn from SEM photograph, female; 14 – fore wing, male; 15 – head, anterior view, female; 16 – habitus, female.

Table 1. Plants with galls that harbor *Cecidellis* Hanson, gen. nov. species in Costa Rica

plant family	plant species	<i>Cecidellis</i> species
Araceae	<i>Philodendron radiatum</i>	<i>C. nigriseta</i>
Asteraceae	<i>Mikania</i> sp.	<i>C. inflativena</i>
	<i>Piptocarpha poeppigiana</i>	<i>C. sp.</i> , possibly <i>nigriseta</i>
Burseraceae	<i>Protium panamensis</i>	<i>C. inflativena</i>
Fabaceae	<i>Inga nobilis</i>	<i>C. inflativena</i>
Lacistemataceae	<i>Lacistema aggregata</i>	<i>C. inflativena</i>
Lauraceae	<i>Nectandra membranacea</i>	<i>C. nectandra</i>
Malvaceae	<i>Malvaviscus arboreus</i>	<i>C. nigriseta</i>
Meliaceae	<i>Guarea</i> sp.	<i>C. sp.</i> possibly <i>inflativena</i>
Moraceae	<i>Ficus colubrinae</i>	<i>C. inflativena</i>
Piperaceae	<i>Piper</i> sp.	<i>C. inflativena</i>
Rubiaceae	<i>Psychotria poeppigiana</i>	<i>C. inflativena</i>
	<i>Sabicea panamensis</i>	<i>C. nigriseta</i>
Verbenaceae	<i>Lantana camara</i>	<i>C. nigriseta</i>
Vitaceae	<i>Cissus</i> sp.	<i>C. nigriseta</i>
Vochysiaceae	<i>Vochysia allenii</i>	<i>C. nigriseta</i>

often have a very reduced speculum outside the basal vein and the median carina of the propodeum weakly developed or absent. But since intermediate-sized specimens are intermediate in coloration and no other distinguishing characters could be found, I am choosing to leave all the specimens seen as *A. wibawae* Heydon, sp. nov. More investigation is needed to determine if more than one species is included herein or if there is some kind of host difference that can affect the morphology of this species. Both color morphs are present in specimens collected from the Chiloé Islands, which would seem to rule out any correlation between color and geography.

ETYMOLOGY. This species is named in honor of Irene Wibawa, a student who has done much research in the Bohart Museum.

BIOLOGY. Specimens of *A. wibawae* Heydon, sp. nov. have been collected off *Berberis* species (Berberidaceae) and *Nothofagus antarcticus* (Nothofagaceae).

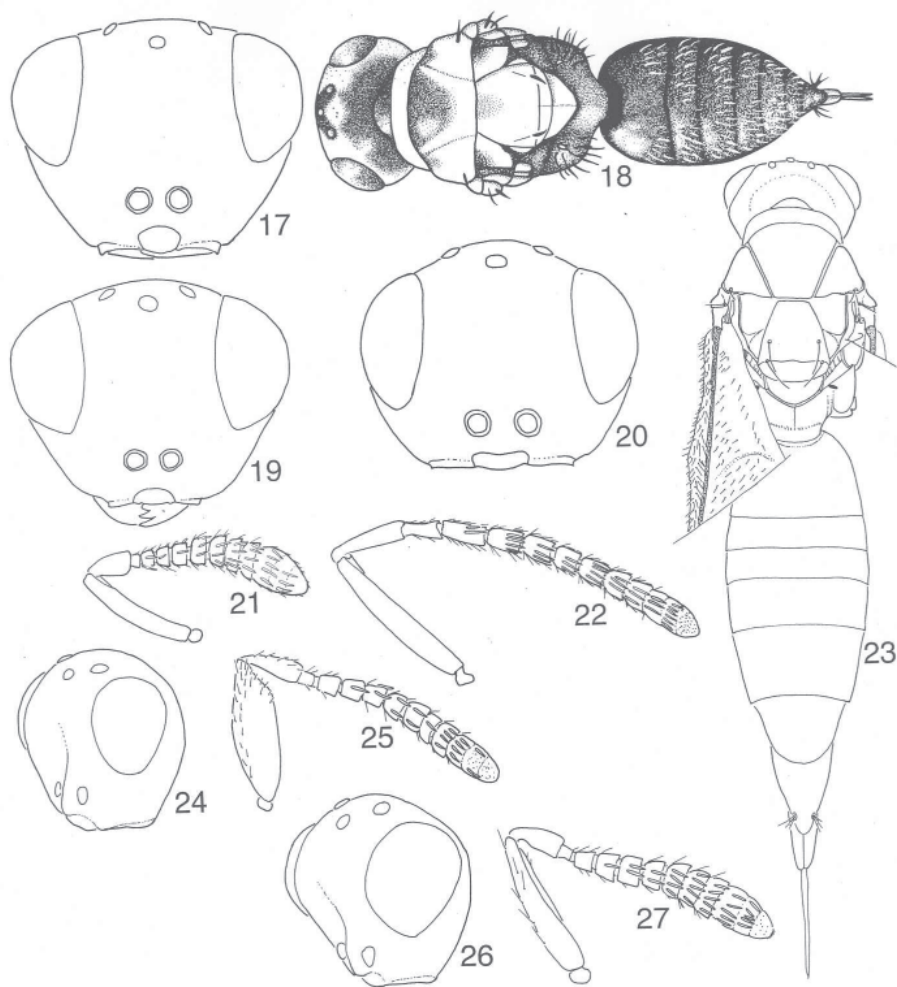
***Cecidellis* Hanson, gen. nov.**

(Fig. 16)

TYPE SPECIES. *Cecidellis nigriseta* Hanson, sp. nov.

DESCRIPTION. Color. Body yellow to very pale brown, non-metallic; wings without colored maculae or bands. Body sparsely to densely covered with semi-erect coarse grayish black setae (Fig. 16). Structure. Right mandible with 4 teeth, left mandible with 3 teeth; labrum with 4 long apical bristles (Fig. 15); anterior margin of head sinuous, clypeus with anterior margin convex (Fig. 15), face just laterad of clypeus projecting to level of middle of clypeus; mouth margin above mandibles arched but not concave; torulus tangent to or just below LOcL; eye almost round, inner orbits with single row of distinct setae extending from occiput to malar sulcus (Fig. 15). Antenna (Fig. 1) with scape slender and cylindrical; basal 2 segments of flagellum anelliform (Fig. 13); with four funicular segments; club symmetric. Mesosoma with short pronotum; complete notauli; scutellum with single pair of black bristles in posterior corners which are only slightly longer and thicker than the other setae of the scutellum, frenal line finely impressed; frenum highly convex longitudinally so hind 1/4 and metanotal area are vertical; dorsellum short, band-like; propodeum (Fig. 2) short (always less than 1/3 as long as scutellum), without basal crescentic cup, with complete median

carina; with short submedian and sublateral pairs of incomplete carinae extending forward from the nuchal region, callus irregularly sculptured and with only 2–3 setae, spiracles large and ovate; pleural regions with femoral depression weakly reticulate and epimeron coriaceous dorsally. Hind coxa bare dorsally; hind tibia with two long apical spurs. Forewing with costal cell exceptionally broad, setose ventrally except just along hind margin; marginal vein longer than postmarginal vein and the latter longer than stigmal vein. Petiole (Fig. 2) transverse but in females with broad trans-



Figs 17–27. *Lanthanomyia* De Santis, species, female. 17 – *L. australis* De Santis, head, anterior view. 18 – *L. compacta* Heydon, sp. nov., dorsal view. 19 – *L. bouceki* Heydon, sp. nov., head, anterior view. 20, 21 – *L. compacta* Heydon, sp. nov.; 20 – head, anterior view; 21 – antenna. 22, 23 – *L. soonae* Heydon, sp. nov.; 22 – antenna; 23 – whole body, dorsal view. 24, 25 – *L. pumita* Heydon, sp. nov.; 24 – head, anterio-lateral view; 25 – antenna. 26, 27 – *L. tigrata* Heydon, sp. nov.; 26 – head, anterio-lateral view; 27 – antenna.

parent dorsal lamina that arches forward and covers nuchal region of propodeum. Gaster with T1 smooth and without basal transverse carina; with deep elongate grooves behind this carina; all tergites separate; cercus with one seta 2× as long as the rest, curved, and brown (Fig. 16); ovipositor distinctly projecting.

DIAGNOSIS. The combination of the reduced number of antennal segments (2 anelli and four funicular segments), the petiole with the thin transparent dorsal lamina, the single long dark cercal seta, and the female with a projecting ovipositor will uniquely identify species in this genus. A key to separate the three described species is found at the end of this paper.

ETYMOLOGY. The generic name is loosely derived from the Greek words *kekis*, meaning gall, and *dellis*, meaning wasp. The gender is feminine.

BIOLOGY. In Costa Rica species of *Cecidellis* Hanson, gen. nov. have been reared from 16 types of galls on 14 families of plants (Table 1). Most are leaf galls, although in the case of *Mikania*, *Malvaviscus*, and *Cissus*, the gall-former appears to induce galls on both leaves and stems of the host plant. The majority of these galls are induced by Cecidomyiidae (probably all undescribed species), although the galls on *Philodendron* and possibly those on *Ficus* are induced by braconids (it is still uncertain whether the galls on *Ficus* are induced by cecidomyiids or braconids in the genus *Labania*). Only a small percentage of the total cecidomyiid galls harbor *Cecidellis* Hanson, gen. nov. At the present time at least 675 cecidomyiid galls have been found in Costa Rica (Hanson & Gómez-Laurito 2004), although perhaps only a third of these have been sufficiently reared to yield any parasitoids at all. Thus, while *Cecidellis* Hanson, gen. nov. will almost certainly be discovered in additional galls, they are nonetheless restricted to a very small subset of the cecidomyiid galls present in the country.

The galls on *Mikania*, *Piptocarpha*, *Protium*, and possibly those on *Nectandra* also harbor *Allorhogas* Gahan, 1912 (Braconidae), some species of which are gall formers but most of which are parasitoids/inquilines in the galls of Cecidomyiidae (Marsh 2002, Wharton & Hanson 2004), as is presumably the case in these galls. This is noteworthy since *Allorhogas*, like *Cecidellis* Hanson, gen. nov., is present in only a very small subset of cecidomyiid galls. As mentioned above, two additional galls also harbor braconids and thus at least five, possibly six, of the 16 galls that harbor *Cecidellis* Hanson, gen. nov. also harbor braconids. Further study is required to determine whether or not this is more than coincidence. With respect to the actual feeding habits of *Cecidellis* Hanson, gen. nov. within the gall, larvae of *C. nigriseta* Hanson, sp. nov. are solitary, ectoparasitic idiobionts (see below) and the biology of the other species is probably similar, although this remains to be demonstrated.

DISTRIBUTION. The new species described here are based primarily on specimens from Costa Rica, but also one from Belize and six from Panama. Insufficient material was available from elsewhere to be included here, but unplaced species (at least some of which are new) were seen from Dominica, Trinidad (reared from leaf galls on *Cordia*, Boraginaceae), Ecuador, Brazil, and even one specimen from Papua New Guinea (with a label indicating that it was reared from Myrtaceae; specimen in BMNH). Although the latter record should be confirmed, *Cecidellis* certainly occurs throughout tropical America.

Cecidellis inflativena Hanson, sp. nov.

(Fig. 11)

TYPE MATERIAL. Holotype (♀, INBio): COSTA RICA, Puntarenas, Isla de Caño, *Lacistema aggregata* leaf gall, 28.VIII.2000, J.A. Azofeifa. Allotype (♂, INBio): same label data as holotype. Paratypes: same data as holotype, 22♀, 14♂ (BMNH, CNC, INBio, MUCR, UCDC, USNM); Puntarenas, Corcovado, Los Charcos, *Inga nobilis* leaf gall, 10.VIII. 1999, 6♀, 1♂ (INBio); same data except Los Patos, *Psychotria poeppigiana* leaf gall, 11.X.2000,

9♀, 5♂ (INBio, MUCR, UCDC); same data except *Mikania* gall, II.2000, 1♀ (INBio); Limón, Aerial Tram, 500m, V.1997, *Protium* “cheerio” gall, 4♀, 7♂ (BMNH, MUCR, USNM); same data except IV.1997, Asteraceae fuzzy spherical leaf gall, 2♀ (MUCR); San José, Ciudad Colón, Hda. Rodeo, 800m, 21.X.1990, *Piper* vein gall, 21♀, 5♂ (BMNH, CNC, MUCR, UCDC); Heredia, 3 km S. Puerto Viejo, La Selva, 100m, 31.III.2002, *Ficus colubrinae* spherical leaf gall, 2♀ (MUCR); BELIZE, Cayo Prov., Las Cuevas Research Station, Chiquibul Forest Reserve, 80km s. Santa Elena, V.1995, 1♀ (BMNH); PANAMA, Barro Colorado Island, 1–17.II.1924, 3♀, 3♂ (one pair are now slide mounted) (UCDC); ECUADOR, Napo Prov., 1km s. Onkone Camp, Reserva Etnicas Waorani, 0° 39'S 76° 26'W (220m, fogging) 1♀, 1♂ (UCRC).

DESCRIPTION. Holotype, female. Color. Body, legs pale yellow, with the following white: face (from clypeus to dorsal end of scrobal depression), lateral panel of pronotum, acropleuron, base of gaster; apical 1/4 of ovipositor black. Antenna with scape white, remainder yellow. Wings with veins pale yellow, membrane faintly so. Microsetae whitish and inconspicuous; longer erect setae (longer than maximal width of antennal club) pale basally and darker apically, mostly restricted to posterior part of vertex, posterior mesoscutum, scutellum. Scutellum (in front of frenal line) with just 2 longitudinal rows of erect setae.

Sculpture. Clypeus smooth, head coriaceous; mesoscutum, scutellum including frenum reticulate–imbricate; dorsellum smooth; gastral tergites smooth; scape smooth.

Structure. Body length 2.3mm. Head width $1.2 \times$ height (41:34), $1.7 \times$ length (41:24); eye height $1.1 \times$ length (25:23), $2.8 \times$ malar distance (25:9), length $5.8 \times$ temple length (23:4); ratio of MOD, OOL, POL, LOL as 3.0:1.5:6.0:4.0. Scrobal depression in form of inverted V, abruptly excavated. Antenna with length of pedicel plus flagellum $0.8 \times$ head width (32:41); relative lengths of scape, pedicel, anelli, F1–4, club as 18:6:1:3:4:4:4:10; widths of F1, F4, club as 2.0:2.5:3.0; MPP sensilla in single row; 2–3 visible per face on each funicular segment. Mesosoma length $1.4 \times$ width (46:34). Posterior margin of propodeum concave so that midline is very short, appearing as a pair of submedian triangles elevated above lateral propodeum and spiracles. Forewing with relative lengths of submarginal, marginal, postmarginal, stigmal veins as 36:31:16:5; speculum mostly devoid of microsetae. Gaster length (excluding ovipositor) $2.3 \times$ width (62:27), $0.9 \times$ combined length of head and mesosoma (62:70); hypopygium extending $0.7 \times$ gaster length (46:62); projecting part of ovipositor $0.85 \times$ hind tibial length (34:40).

Allotype, male. The allotype resembles the holotype except for the following: Body length 1.8 mm. Antenna with length of pedicel plus flagellum $0.74 \times$ head width (28:38); relative length of scape, pedicel, anelli, F1–4, club as 15.0:6.0:1.0:2.0:2.5:3.5:3.5:9.0; relative widths of F1, F4, club as 1.5:2.0:2.5. Forewing with submarginal vein greatly enlarged (Fig. 11).

VARIATION. Body length of females varies from 1.5 to 2.3 mm. Some specimens are more extensively white, including most of mesoscutum and apex of gaster.

ETYMOLOGY. The species name is based on the Latin words *inflatus* meaning swollen and *vena* meaning blood vessel, referring to the swollen submarginal vein in the males of this species.

BIOLOGY. *Cecidellis inflativena* Hanson, sp. nov. has been reared from seven distinct galls (Table 1), all of which are formed by Cecidomyiidae, with the possible exception of those on *Ficus*.

***Cecidellis nectandra* Hanson, sp. nov.**

(Fig. 12)

TYPE MATERIAL. Holotype (♀, INBio): COSTA RICA, Alajuela, Reserva Biológica Alberto Brenes (San Ramón), 900 m, 6.IV.2003, P. Hanson, *Nectandra membranacea* leaf galls Allotype (♂, MUCR): same label data as holotype. Paratypes: 4♂ same label data as holotype (BMNH, UCDC, USNM); 1♂ same data except III.2001 (CNC).

DESCRIPTION. Holotype, female. Color. Body, legs, antenna pale yellow with faint dark band on frenal line, propodeum slightly darkened, gaster with dark transverse subapical bands on T2–4,

apical 1/2 of ovipositor dark; ventral surface of scape, lateral panel of pronotum, acropleuron, base of gaster white. Wings with veins pale yellow, membrane hyaline. Vertex (including upper inner orbits), mesoscutum, scutellum with black erect setae, most of which are longer than maximum width of antennal club. Scutellum (in front of frenal line) with just 2 longitudinal rows of erect setae.

Sculpture. Clypeus smooth; head weakly reticulate–imbricate; mesoscutum, scutellum reticulate; frenum more imbricate; dorsellum and gastral tergites smooth; scape smooth.

Structure. Body length 1.9 mm. Head width $1.2 \times$ height (41:33), $2.2 \times$ length (41:19); eye height $1.3 \times$ length (20:16), $2.2 \times$ malar distance (20:9), length $5.3 \times$ temple length (16:3); ratio of MOD, OOL, POL, LOL as 2:3:10:5. Scrobal depression in form of inverted V, very weak and shallowly excavated. Antenna with length of pedicel plus flagellum $0.68 \times$ head width (28:41); relative lengths of scape, pedicel, anelli, F1–4, club as 16:4:1:3:4:3:3:7; widths of F1, F4, club as 2:3:4; MPP sensilla in single row; 4–5 visible per face on each funicular segment. Mesosoma length $1.4 \times$ width (44:32). Propodeum with posterior margin more or less straight (not concave), with outwardly angled submedian carinae (forming a diamond shape) and very narrow carinate grooves just mesad of spiracles, beginning at anterior margin, converging posteriorly, but not reaching posterior margin. Forewing with relative lengths of submarginal, marginal, postmarginal, stigmal veins as 31:24:15:7; costal cell with setae restricted to underside and speculum mostly bare. Gaster length (excluding ovipositor) $1.9 \times$ width (46:24), $0.73 \times$ combined length of head and mesosoma (46:63); hypopygium extending $0.59 \times$ gaster length (27:46); projecting part of ovipositor $0.37 \times$ hind tibial length (11:30).

Allotype. The allotype resembles the holotype except for the following: Body length 1.2 mm. Antenna with length of pedicel plus flagellum $0.63 \times$ head width (19:30); relative length of scape, pedicel, anelli, F1–4, club as 12.0:3.5:1.0:1.5:2.0:2.0:2.5:6.0; relative widths of F1, F4, club as 1.5:2.0:2.5. Forewing with parastigma greatly enlarged, in form of a semicircle.

VARIATION. Because this species is known from only a small series of specimens reared from the same gall, very little variation is evident in the material examined.

ETYMOLOGY. The species name is derived from the genus name of the host plant.

BIOLOGY. *Cecidellis nectandra* Hanson, sp. nov. has been reared from just one type of gall, spherical (3–4 mm in diameter), reddish colored leaf galls found on *Nectandra salicina*, which are formed by an undescribed species of Cecidomyiidae.

***Cecidellis nigriseta* Hanson, sp. nov.**

(Figs 1, 2, 13–16)

TYPE MATERIAL. Holotype (♀, INBio): COSTA RICA, Limon, 13 km west and 3 km north of Guapiles, 100m, 20.XI.1991, P. Hanson, *Monitoriella elongata* galls on *Philodendron radiatum*. Allotype (♂, INBio): same label data as holotype. Paratypes: same data except 9.XII.1990, 5♀, 30 (INBio); Heredia, 3km s. Puerto Viejo, La Selva, 100m, 1.1998, same host, 10♀, 6♂ (BMNH, MUCR, USNM); same data except IX.1992, 3♀, 2♂ (UCDC); same data except XI.1992, 1♀, 3♂ (CNC); same data except XII.1992, 1♀, 3♂ (USNM); same data except 23.X.1991, 2♂ (INBio); same data except 5.III.1994, 4♀ (MUCR); same data except VIII.1997, 1♀ (UCDC); Guanacaste, Palo Verde (10m, Cecid. leaf gall on *Cissus*), 10.XI.2000, 5♀, 3♂ (INBio, MUCR, USNM); same data except galls on *Malvaviscus arboreus*, V–VII.2000, 3♀ (INBio, MUCR); Guanacaste, R.F. Monte Alto, Hojancha (500m, *Lantana* gall), 28.VIII.2001, 5♂ (INBio, MUCR); Puntarenas, R.F. Golfo Dulce, 24km w. Piedras Blancas (200m, *Vochysia* leaf gall), 6♀, 3♂ (MUCR, UCDC, USNM); Heredia, 12km sw. Horquetas (550m, *Sabicea*), 27.IX.1987, 1♂ (MUCR); same data except Compositae (MUCR); Puntarenas, Pen. Osa, Pto. Jiménez (10m), IV.1992, 1♂ (MUCR); same data except VIII–IX.1992, 1♀ (MUCR), Guanacaste, Sta. Rosa NP, Hacienda, 27.IV–11.V.1985, 1♀ (BMNH); same data except 23.III–13.IV.1986, 2♀ (BMNH); same data except 4–24.V.1986, 1♀ (BMNH); same data except 14.VI–5.VII.1986, 2♀ (BMNH); same data except 28.XII.1985–18.I.1986, 1♀ (MUCR); same data except I.1997, 1♀ (MUCR); same data except II. 1987, 2♀ (MUCR); BELIZE, Cayo Prov.: Las Cuevas Research Station, Chiquibul Forest Reserve, 80km s. Santa Elena, V.1995, 1 ♀ (UCDC).

DESCRIPTION. Holotype, female. Color. Body, legs, antenna pale yellow except for T2–4 which have transverse subapical dark bands and ovipositor with apical 1/3 black. Wings with veins pale yellow, membrane hyaline. Vertex (including upper inner orbits), mesoscutum, scutellum densely clothed with black erect setae, most of which are longer than maximum width of antennal club. Scutellum (in front of frenal line) with more than 2 longitudinal rows of erect setae.

Sculpture. Clypeus smooth; head reticulate–imbricate; mesoscutum, scutellum reticulate; frenum more imbricate; dorsellum smooth, gastral tergites weakly coriaceous; scape smooth.

Structure. Body length 2.4 mm. Head (Fig. 15) width $1.3 \times$ height (44.0:34.5), $1.9 \times$ length (44:23); eye height $1.2 \times$ length (22:19), $2.2 \times$ malar distance (22:10), length $4.8 \times$ temple length (19:4); ratio of MOD, OOL, POL, LOL as 3.0:2.0:9.0:5.5. Scrobal depression in form of inverted V, gradually excavated. Antenna (Figs 1, 13) with length of pedicel plus flagellum $0.64 \times$ head width (28:44); relative lengths of scape, pedicel, anelli, F1–4, club as 18.0:6.0:1.5:3.0:4.0:3.5:3.5:7.0; widths of F1, F4, club as 3:3:4; MPP sensilla in single row; 4–5 visible per face on each funicular segment. Mesosoma length $1.4 \times$ width (49:35). Propodeum (Fig. 2) with posterior margin more or less straight (not concave), with carinate excavation extending from posterior margin to spiracle. Forewing with relative lengths of submarginal, marginal, postmarginal, stigmal veins as 38:26:7:20; costal cell and speculum extensively setose. Gaster length (excluding ovipositor) $3.0 \times$ width (59:20), $0.89 \times$ combined length of head and mesosoma (59:66); hypopygium extending $0.51 \times$ gaster length (30:59); projecting part of ovipositor $0.74 \times$ hind tibial length (26:35) (Fig. 16).

Allotype, male. The allotype resembles the holotype except for the following: Body length 1.9 mm. Antenna with length of pedicel plus flagellum $0.69 \times$ head width (35:51); relative length of scape, pedicel, anelli, F1–4, club as 19.0:9.0:1.0:3.0:4.0:4.0:4.0:10.0; relative widths of F1, F4, club as 2.5:3.0:4.0. Forewing with submarginal vein and parastigma not enlarged (Fig. 14).

VARIATION. The females examined vary in length from 1.7 to 3.2 mm (males 1.3 to 1.9 mm); smaller specimens, especially males, have shorter, paler setae. Some females have a dark transverse band on the frenal line and the number of transverse bands on the gaster varies from 1 to 4. The most deviant specimens are those reared from *Cissus* galls, which are very small (females 1.7 mm), have a relatively less massive head, the speculum more bare, and the ovipositor less exerted; further study is required to determine if indeed they belong here.

ETYMOLOGY. The species name is based on the Latin words *nigra* meaning black and *seta* meaning bristle, referring to the black bristles that cover the body.

BIOLOGY. In Costa Rica *Cecidellis nigriseta* Hanson, sp. nov. has been reared from six distinct types of galls (Table 1). Except for those on *Philodendron*, the galls are formed by Cecidomyiidae. *Cecidellis nigriseta* Hanson, sp. nov. has been reared repeatedly from leaf galls on *Philodendron radiatum* (Araceae), which are formed by *Monitoriella elongata* Hedqvist (Braconidae). Together with the other parasitoids of *M. elongata*, *C. nigriseta* Hanson, sp. nov. was briefly mentioned in Infante et al. (1995; cited as “undescribed genus of Pteromalidae”). In Costa Rica, this species is the most common parasitoid of this host. The larvae are setose and were observed feeding as ectoparasitic idiobionts of larvae, pupae and even unclosed adults of *M. elongata*. They were more commonly found on later instar braconid larvae, perhaps because the young galls are well concealed within the tightly rolled, young leaves of *Philodendron* (when the leaves expand and unroll, most of the galls are quite mature). Because the late instar braconid larva is much larger than that of *C. nigriseta* Hanson, sp. nov., and the latter is a solitary parasitoid, a considerable amount of unutilized host tissue remains after the parasitoid completes its larval development. It is possible that *C. nigriseta* Hanson, sp. nov. is capable of developing as a facultative hyperparasitoid since it was occasionally found associated with pupae of *Eurytoma* sp. (Eurytomidae) that were either paralyzed or dead.

***Lanthanomyia* De Santis, 1967**

(Figs 3, 18)

Lanthanomyia De Santis, 1967: 3–4 (type species: *Lanthanomyia australis* De Santis, 1967; original designation, examined); 1972: 63 (description of the male).

DESCRIPTION. Color. Body non-metallic with species often with highly contrasting areas of yellow and black (Fig. 18); wings with at most weak colored maculae in immediate vicinity of stigma. Antenna (Figs 4, 21–22, 25, 26) with basal segment of flagellum varying from anelliform to elongate, but without MPP sensilla; with seven funicular segments. Mesosoma with pronotum having horizontal collar rounding into sloping neck (Fig. 3); complete notauli; scutellum with two pairs of black bristles (Fig. 23); propodeum with median panels bare (Fig. 5); propodeum distinctly more than half as long as scutellum, without basal crescentic cup; pleural regions smooth. Hind coxa with dorsal surface bare; with dense elongate pits that form a circular “finger print” pattern on its lateral side (Fig. 5). Fore wings with speculum though it is sometimes reduced in size. Gaster with base of T1 unmodified (Fig. 5), dorsal surface smooth or reticulate; all tergites separate.

DIAGNOSIS. The combination of the non-metallic coloration, single anelliform antennal segment, the pronotum with a horizontal collar, the complete notauli, two pairs of scutellar setae, forewing with developed speculum, and unique sculpturing of the hind coxae will serve to distinguish *Lanthanomyia* from the other described genera of Coelocybinae. However, based on the examination of *Ambogaster* Heydon, gen. nov., *Coelocyba nigrocincta* Ashmead, 1900 (the type series), and *Cytopella* sp., none of these characters are apomorphic relative to the character states in *Ambogaster* Heydon, gen. nov. except possibly the distinctive sculpturing of the hind coxa.

In the key to the genera of Australasian Pteromalidae, Bouček (1988) listed one undescribed genus of Coelocybinae from South America. Characters given to distinguish this genus from the Australasian genera were the proximal three funicular segments elongate, the hind coxae and T1 with deep puncturation, and the scutellum with two pairs of strong setae and a distinct frenal groove. The specimen referred to as “Coelocybinae n. gn.” sensu Bouček from the USNM was examined and belongs to the species described herein as *L. soonae* Heydon, sp. nov. The other species of *Lanthanomyia* resemble *L. soonae* Heydon, sp. nov. in overall morphology, but the first antennal segment varies from as long as wide in the large and medium sized species to distinctly anelliform in the smallest species. So the elongation of the basal flagellar antennal segments is not a good generic character, but a result of allometry as *Lanthanomyia* species get larger.

***Lanthanomyia australis* De Santis, 1967**

(Fig. 17)

Lanthanomyia australis De Santis, 1967: 5–6 (holotype, ♀; MLPA: examined); 1972: 63 (description of the male).

TYPE MATERIAL EXAMINED. The holotype female (MLPA) is mounted on a point. It has been much damaged and the head and one wing are completely missing. It is possible that they are on a slide since the original publication has them both figured and the antenna has the stretched and swollen appearance characteristic of slide-mounted antennae. It was collected at Punto Maria, Magallanes, Chile on 19 February 1951.

ADDITIONAL MATERIAL EXAMINED (BMNH, MLPA, UCDC). Argentina. TIERRA DEL FUEGO: Estancia San Justo, 54°05'S 68°37'W, 1–15.II.1998 (*Nothofagus* forest survey), 20♂; Ushuaia, Cañadón del Toro (c. 500m), 25.I.1998 [ex galls of *Apion fuegianum* Enderlein, 1912 (Curculionidae) on *Nothofagus pumilo*, emerging on various dates between 29.I.–2.II.1998], 12♀, 6♂. Chile. MAGALLANES: Punta Arenas, Institut de La Patagonia, 16.I.1998 [ex galls of *Apion fuegianum* Enderlein (Curculionidae) on *Nothofagus antarctica*, em. 19–20.I.1998], 1♀, 1♂.

DESCRIPTION. Holotype, female. Color. Head dirty yellow with grayish brown streaks running along inner orbits from median ocellus to toruli; occiput dark brown. Mesosoma with pronotum yellow dorsally and lateroventrally, shoulders brown, neck black; dorsum brownish black with the individual sclerites tending to be margined in yellow (entire frenal area yellow); pleural areas brown; propodeum black. Gaster with dorsum of T1 black, becoming more yellow ventrally and apically; ovipositor sheaths black. Antenna yellowish brown, scape slightly paler than flagellum. Legs dirty yellow except hind coxa turning almost black basally and hind femur with broad weak dark mesal band. Wings hyaline; submarginal vein pale brown; remainder of venation dirty yellow. Microsetae white.

Sculpture. Frenum, dorsellum, propodeum with fine longitudinal ridges; metapleuron smooth.

Structure. Body length 3.3mm. Head (Fig. 17) width $1.2 \times$ height (33.5:27.0), $2.1 \times$ length (33.5:16.0); eye height $1.2 \times$ length (14.5:12.0), $1.3 \times$ malar distance (14.5:11.0), length $4.0 \times$ temple length (12:3); relative lengths of MOD, OOL, POL, LOL as 2.0:4.0:8.5:5.0. Antenna with length of pedicel plus flagellum $1.0 \times$ head width (35.0:33.5); relative lengths of scape, pedicel, anellus, F1–7, club as 19.0:8.0:2.0:3.0:3.0:2.5:2.5:2.5:2.5:2.5:7.0; relative widths of F1, F7, club as 2.0:4.0:4.5; scape cylindrical, length $8.5 \times$ width (19:2). Mesosoma length $1.9 \times$ width (56.0:29.5). Forewing length $2.8 \times$ width (134:48); relative lengths of submarginal, marginal, postmarginal, stigmal veins as 53:26:29:13; basal cell setose except for narrow band along hind margin. Gaster length $3.6 \times$ width (102:35), $1.6 \times$ combined length of head and mesosoma (102:65); T1 extending $0.16 \times$ gaster length (17:102), rounded anteriorly.

Male. Similar to holotype except entire body yellow outside of narrow band between lateral ocelli and median ocelli, anterior margin of mesoscutum, diffuse lateral spot on propodeum, wide median spot on T2 brown; neck and dorsum of T1 black. Body length 2.0mm. Antenna with length of pedicel plus flagellum $1.0 \times$ head width (30:29); relative lengths of scape, pedicel, anellus, F1–7, club as 15:7:1.5:2.5:2.5:2.5:2.5:2.5:2.5:2.5:6.0; relative widths of F1, F7, club as 2.0:3.0:4.0;

***Lanthanomyia bouceki* Heydon, sp. nov.**
(Figs 3–5, 19)

TYPE MATERIAL. Holotype female (MNNC), allotype male (MNNC), and 1 female and 4 male paratypes (all UCDC) from Chile, IX Región, sweeping vegetation in the ravine near the parking lot at the end of the road to Volcán Villarica (29°22'S 71°57'W), Parque Nacional Villarica, on 7.XII.1994 by S. L. Heydon and E. Arias. Fifty-one additional paratypes were collected as follows (BMNH, MNNC, MUCR, UCDC, USNM): ARGENTINA. Neuquén, Parque Nacional Lanin, 2km nw. Nonthué (40°08'S 71°38'W), 20–24.II.1999, MT, 3♀. CHILE. VII Región: Portrero Grande (35°12'S 70°08'W), 11.XII.1990, 1♀; Vilches (35°36'S 71°04'W), 18.XII.1996, 1♀. IX Región: nr. Collipulli (cruce camino a Los Copihues), 28.XII.1988, 1♀; 7.5km e. Pucón (at Río Turbio, 39°18'S 71°54'W), 1♂; ~28km se. Pucón (Salto El Puma, 39°25'S 71°45'W), 7.XII.1994, 2♀, 1♂; road to Volcán Villarica at the Río Seco (39°20'S 71°58'W), 7.XII.1994, 2♀; Parque Nacional Nahuelbuta (Centro de Informaciones, 37°49'S 73°00'W), 8.XII.1994, 13♀. X Región: Abtao, 23.II.1991, 1♀; 3km e. Ensenada, (41°13'S 72°30'W), 1♂; Lago Calafquén, (Casa de Piedra), 26.I.1995, 1♀; Parque Nacional Conguillío (1150m), 4.II.1980, 2♀, 1♂; Petrohué (Parque Nacional V. Perez Rosales, 41°08'S 72°24'W), 3.XII.1994, 1♀, 1♂; Valdivia (Mon Alerces), 1–12.XII.1988, 1♂. Isla Chiloé: camino a Manao, 4.II.1988, 1♂; Piruquina, 16.II.1995, 1♀. Isla Quinchao: Quetro, 16.II.1996, 1♀. XII Región: Laguna Escondida, 17.II.1990 (off *Nothophagus antarctica* and *N. pumilio*), 1♀; 14km e. Matalcahuello (1570m), 13–31.XII.1982, (trap site 649, Noth. - Pumilio - Araucaria forest), 3♀, 10 ♂.

DESCRIPTION. Holotype, female. Color. Head yellow with occiput and „V“-shaped patch around ocelli black; mesosoma brownish black with the following regions yellow-dorsum of collar, mid-lobe of mesoscutum along notauli, side lobes of mesoscutum except for anteromedian brown patch, scutellum except for anteromedian brown patch, frenum, dorsellum; gaster brown except for ovate yellow patches on anterolateral parts of T2–5. Antenna yellow with scape and pedicel

brownish dorsally. Legs yellow except pretarsi and basal 2/3 of hind coxa dark brown. Wings hyaline except for diffuse brown macula extending posteriorly from stigma; submarginal vein and end of stigmal vein reddish yellow, remainder of venation yellow. Microsetae white.

Sculpture. Frenum and dorsellum reticulate; anterior 1/3 of propodeum smooth; metapleuron smooth.

Structure. Body length 2.4 mm. Head (Fig. 19) width $1.2 \times$ height (32.5:27.0), $1.9 \times$ length (32.5:17.0); eye height $1/1 \times$ length (15.5:14.0), $1.6 \times$ malar distance (15.5:10.0), length $9.3 \times$ temple length (14.0:1.5); relative lengths of MOD, OOL, POL, LOL as 2.0:3.0:9.0:5.5. Antenna (Fig. 4) with length of pedicel plus flagellum $0.92 \times$ head width (30.0:32.5); scape cylindrical, length $5.0 \times$ width (15:3); anellus as long as wide; relative lengths of scape, pedicel, anellus, T1–7, club as 15.0:6.5:1.5:2.0:2.5:2.5:2.5:2.0:2.0:6.0; widths of F1, F7, club as 2:4:4. Mesosoma length $1.7 \times$ width (47:27). Forewing length $2.3 \times$ width (103:44); relative lengths of submarginal, marginal, postmarginal, stigmal vein as 40:18:23:10; basal cell with posterior 1/2 bare. Gaster length $2.1 \times$ width (64:30) (Fig. 3), $1.1 \times$ combined length of head and mesosoma (64:58); T1 extending $0.23 \times$ gastral length (15:64), rounded anteriorly.

Allotype, male. Similar to holotype except scutellum black along entire length anterior to frenal groove and between bristle pairs; gaster black. Wings hyaline. Body length 1.7 mm. Antenna with length of pedicel plus flagellum $0.97 \times$ head width (29:30); relative lengths of scape, pedicel, anellus, F1–7, club as 15.0:6.0:1.5:2.0:2.0:2.5:2.5:2.0:2.0:1.5:7.0; relative widths of F1, F7, club as 2.0:4.0:4.0; club with ovate terminal patch of micropilosity on the end of the club.

VARIATION. This species exhibits much greater variation in size, structure and color than the other species treated herein. Females examined varied in length from 1.5–2.8 mm and males from 1.3–2.0 mm. The darkest specimens had the head with a distinct V-shaped black macula around the ocelli; the mesosoma almost completely black dorsally except for yellow coloration along the lateral edges of the midlobe and side lobes of the mesoscutum, the mesal edge of the axilla and the frenum and lateral edge of the scutellum; and the gaster completely black. The palest specimens examined had the vertex uniformly yellow, the mesosoma yellow or reddish brown dorsally and even laterally in one specimen, and the gastral terga beyond T1 yellowish brown except for diffuse, transverse brown stripes across each tergite. The areas that were black in all specimens examined were the occiput, neck, propodeum, and ovipositor. The smallest specimens had the anellus and all funicular segments transverse. The larger specimens had the anellus and basal funicular segments longer than wide. The gaster length varies from 0.8 – $1.4 \times$ the combined length of the head and mesosoma. In the paratype series, all intermediates between these sizes, colors and proportion were represented. Further investigation is needed to determine whether this variation is due to genetic, host, or other environmental effects or whether what I recognize as one species here is actually a species complex.

ETYMOLOGY. It is our honor to name the most commonly collected species in the New World coelocybinae fauna after our friend and mentor, Zdeněk Bouček.

Lanthanomyia compacta Heydon, sp. nov.

(Figs 18, 20, 21)

TYPE MATERIAL. The holotype female (MNHC) and 3 paratype females (MUCR, UCDC) were collected from Chile, IX Región, 7.5 km e. Pucón (39°18'S 71°54'W, 360m), where the road crosses the Río Turbio on 6.XII.1994 by S. L. Heydon and E. Arias. One additional paratype female was collected as follows (UCDC): CHILE. IX Región: Salto El Puma, ~28 km se. Pucón (39°25'S 71°45'W) on 7.XII.1994.

DESCRIPTION. Holotype, female. Color (Fig. 18): Head yellow except for occiput and ovate patch from posterior ocelli to top of scrobes black; Mesosoma with neck, pleura, propodeum brownish black, dorsum yellow except the following brownish black—anteromedian triangle on midlobe of mesoscutum, anteromedian ovate patch on side lobe and scutellum, anterolateral patch on axilla; gaster brownish black. Antenna brownish yellow with dorsum of scape and pedicel darker. Legs yellow except basal 2/3 of hind coxa brownish black, tarsi brownish yellow. Wings hyaline with veins brownish yellow, apical parts of submarginal and stigmal veins darker. Microsetae black.

Sculpture. Frenum, dorsellum, propodeum reticulate; metapleuron smooth.

Structure. Body length 1.6 mm. Head (Fig. 20) width $1.2 \times$ height (28:23), $1.9 \times$ length (28:15); eye height $1.1 \times$ length (13.5:12.0), $1.7 \times$ malar distance (13.5:8.0), length $6.0 \times$ temple length (12:6); relative lengths of MOD, OOL, POL, LOL as 2.0:4.5:7.0:3.0. Antenna (Fig. 21) with length of pedicel plus flagellum $0.86 \times$ head width (24:28); relative lengths of scape, pedicel, anellus, F1–7, club as 13.0:5.0:1.0:1.5:1.5:2.0:2.0:2.0:2.0:6.0; relative widths of F1, F7, club as 2:3:4; scape cylindrical, length $5.2 \times$ width (13.0:2.5). Mesosoma length $1.5 \times$ width (38:26). Forewing length $2.3 \times$ width (40:24); relative lengths of submarginal, marginal, postmarginal, stigmal veins as 29.0:13.0:16.0:6.5; basal cell entirely setose. Gaster length $1.7 \times$ width (40:24); $0.85 \times$ combined length of head and mesosoma (40:47) (Fig. 18); T1 extending $0.30 \times$ gaster length (12:40), rounded anteriorly.

Male unknown.

VARIATION. The body length of females examined varied between 1.6 and 1.8 mm. The smallest specimen has the anterior pair of scutellar setae weakly developed. The coloration of the holotype is typical of all specimens examined except one has the pale areas of the scutellum and axilla brown instead of the yellow color found in the other paratypes.

ETYMOLOGY. The species name refers to the short, compact nature of this species.

***Lanthanomyia pumita* Heydon, sp. nov.**
(Figs 24–25)

TYPE MATERIAL. Holotype female (MNNC) and 2 female paratypes (UCDC) were collected from Chile, IX Región, from the *Nothofagus* in the ravine near the parking lot at the end of the road on Volcán Villarica, Parque Nacional Villarica, 29°22'S 71°57'W, on 7.XII.1994 by S. L. Heydon and E. Arias. Two additional paratype females were collected as follows: CHILE. X Región: 3km e. Ensenada (41°13'S 72°30'W), 3.XII.1994 and Petrohué (Parque Nacional V. Perez Rosales, 41°08'S 72°24'W), 3.XII.1994.

DESCRIPTION. Holotype, female. Color. Head yellow ventrally, more orange from ocelli anteriorly to scrobe, occiput brownish black. Mesosoma with dorsum orange except for weak median band and lateral regions of neck dark brown; lateral edges of midlobe, lateral edges of midlobe, posterior half of side lobes, frenum yellow; side of mesosoma yellow with pronotum and metapleuron more orange; propodeum brownish black. Gaster reddish brown, becoming more yellow ventrally and apically; basal 1/2 of T1 brownish black; ovipositor sheaths black. Antenna yellow with dorsal surfaces slightly darker brown. Legs yellow except terminal tarsomeres becoming brown. Wings hyaline except parastigma and end of stigmal vein reddish brown. Microsetae black.

Sculpture. Frenum, dorsellum, propodeum coriaceous; metapleuron smooth.

Structure. Body length 2.1 mm. Head (Fig. 24) width $1.2 \times$ height (31:26), $1.4 \times$ length (26:18); eye height $1.2 \times$ length (14:12), $1.4 \times$ malar distance (14:10), length $2.2 \times$ temple length (12.0:5.5); relative lengths of MOD, OOL, POL, LOL as 2.0:3.5:8.5:5.0. Antenna with length of pedicel and flagellum $0.95 \times$ head width (29:31); relative lengths of scape, pedicel, anellus, F1–7, club as 15.0:6.0:1.5:2.0:2.0:2.5:2.0:2.0:2.0:6.5; relative widths of F1, F7, club as 2.0:3.5:3.5; scape flattened, length $3.3 \times$ width (15.0:4.5) (Fig. 25). Mesosoma length $1.7 \times$ width (45:27). Forewing length $2.4 \times$ width (97:41); relative lengths of submarginal, marginal, postmarginal, stigmal veins as

38.0:16.0:20.0:8.5; basal cell with broad bare area anterior to hind margin. Gaster length $2.0\times$ width (53:26), $0.91\times$ combined length of head and mesosoma (53:58); T1 extending $0.23\times$ gaster length (12:53), rounded anteriorly.

Male unknown.

VARIATION. The females examined varied in body length from 2.1–2.6 mm. The amount of black coloration was variable. The darkest specimens differ from the type in having an elongate oval black patch on the neck, a transverse black patch along the anterior margin of the middle lobe of the mesoscutum, and anterior median spots on the side lobes. The lightest specimens had only the anterior 1/4 of the gastral T1 black.

ETYMOLOGY. The species name is a Latinized version of the diminutive of the Spanish word *puma*, and refers to the lion like color of this species.

***Lanthanomyia soonae* Heydon, sp. nov.**
(Figs 22, 23)

TYPE MATERIAL. The holotype female (MNNC) was collected in Chile, IX Región, at Salto El Puma (~28km se. Pucón, 39°25'S 71°45'W) on 7.XII.1994 by S. L. Heydon and E. Arias. Two additional paratype females were collected as follows (CASC, USNM): CHILE. Región VI: Las Cabras, 10–25.XII.1954. ARGENTINA. Prov. Río Negro: Lago Masecardi, 1km n. Villa Masecardi (850m), 18.XI.1966. One other female that probably belongs here was collected as follows (UCDC): CHILE. Región IX, Parque Nacional Nahuelbuta, 1.II.1993.

DESCRIPTION. Holotype, female. Color. Head yellow with upper 1/4 of scrobes and vertex more orange; mesosoma orangish yellow with the following yellow–collar, posterior and lateral parts of middle and side lobes of mesoscutum, frenum, dorsellum, upper edge of mesopleuron; propodeum black with callus and anterior 1/2 orange; gaster with T1–5 black dorsally, with anterolateral yellow spot and remainder orangish yellow; T6&7 orangish yellow, ovipositor black. Antenna with scape and pedicel yellow, remainder orangish brown. Legs yellow with ovate dark patches on ventral and lateral faces of fore femur and inner, outer and ventral face of hind femur; tarsi brown. Wings hyaline; submarginal vein brown, remainder of venation yellowish but stigmal vein darkening apically. Microsetae black.

Sculpture. Frenum and dorsellum coriaceous; almost entire propodeum reticulate; metapleuron smooth.

Structure. Body length 4.7 mm. Head width $1.5\times$ height (57:39), $2.5\times$ length (57:23); eye height $1.4\times$ length (23:17), $1.5\times$ height (57:39), $2.5\times$ length (57:23); eye height $1.4\times$ length (23:17), $1.5\times$ malar distance (23:15), length $3.4\times$ temple length (17:5); relative lengths of MOD, OOL, POL, LOL as 3.0:4.5:11.0:6.0. Antenna (Fig. 22) with length of pedicel plus flagellum $1.2\times$ head width (57:47); relative lengths of scape, pedicel, anellus, F1–7, club as 27.0:10.0:5.0:8.0:6.5:5.5:5.0:4.5:4.5:4.0:12.0; relative widths of F1, F7, club as 3:4:4; scape length $6.8\times$ width (27:4), cylindrical; anellus length ~2.5 width. Mesosoma length $1.8\times$ width (84:46). Forewing length $2.8\times$ width (194:70; relative lengths of submarginal, marginal, postmarginal, stigmal veins as 80:31:46:20; basal cell with narrow bare strip anterior to cubital setae. Gaster length $2.7\times$ width (140:51), $1.4\times$ combined length of head and mesosoma (140:97) (Fig. 23); T1 extending $0.19\times$ gaster length, rounded anteriorly.

Male unknown.

VARIATION. The body length of the paratype female is 4.4 mm. It is very similar morphologically to the holotype except its entire propodeum is orange.

ETYMOLOGY. This species is named in honor of our former preparator here in the Bohart Museum, Hyunsoon Kang.

***Lanthanomyia tigrata* Heydon, sp. nov.**

(Figs 26, 27)

TYPE MATERIAL. Holotype female (MNNC) is from Chile, IX Región, Salto El Puma (~28km se. Pucón, 39°25'S 71°45'W) and collected 7.XII.1994 by S. L. Heydon and E. Arias. Three additional paratypes were collected as follows (UCDC): CHILE. IX Región: Volcán Villarica, Parque Nacional Villarica (29°22'S 71°57'W), 7.XII.1994, 2♀. X Región: Parque Nacional Conguillío (1150m), 4.II.1980, 1♀.

DESCRIPTION. Holotype, female. Color. Same as *L. bouceki* except dark patch on vertex „H“-shaped and yellow coloration extending 1/2 way down collar laterally.

Sculpture. Frenum, dorsellum coriaceous; propodeum, metapleuron with weak coriaceous sculpturing.

Structure. Body length 5.8 mm. Head (Fig. 26) width 1.2× height (43:36), 2.0× length (43:22); eye height 1.2× length (20.0:16.5), 1.7× malar distance (20:12), length 4.1× temple length (16.5:4.0); relative lengths of MOD, OOL, POL, LOL as 3.5:4.5:11.0:6.5. Antenna (Fig. 27) with length of pedicel and flagellum 0.86× head width (37:43); relative lengths of scape, pedicel, anellus, F1–7, club as 20.0:7.0:2.0:3.0:3.0:3.0:3.0:2.5:2.5:2.5:7.5; relative widths of F1, F7, club as 3:5:5; scape length 4.0× width (20:5), flattened with anterior edge carinate; anellus as long as wide. Mesosoma length 1.6× width (63:40). Fore wing length 2.4× width (122:50); relative lengths of submarginal, marginal, postmarginal, stigmal veins as 53:23:33:14; basal cell with bare strip along posterior margin. Gaster length 1.9× width (72:38), 0.96× combined length of head and mesosoma (72:75); T1 extending 0.32× gaster length (32:72), rounded anteriorly.

Male unknown.

VARIATION. Of the four specimens seen, the holotype has the most black coloration. The paratype from Conquillo has almost the same color pattern, but has the dark region on the vertex restricted to the region around the ocelli.

ETYMOLOGY. The species name is a Latinized version of the diminutive of the Spanish word *tigre*, and refers to the striped tiger like coloration of this species.

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The gender and derivation of genus-group names in Mymaridae and Mymarommatidae (Hymenoptera)

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Abstract. The gender and derivation of 181 genus-group names of Mymaridae and 6 of Mymarommatidae are given, excluding homonyms, unnecessary replacement names, and unjustified emendations, which are listed separately. Three genera are removed here from the Mymaridae: *Metanthemus* Girault, 1928 is transferred to Aphelinidae, *Allomymar* Kieffer, 1913 probably belongs to the Aphelinidae but its type needs to be located to verify this placement, and *Shillingsworthia* Girault, 1920 is a hypothetical concept, excluded from zoological nomenclature. *Enneagmus* Yoshimoto, 1975, an extinct genus with 3-segmented tarsi, is transferred from Trichogrammatidae to Mymaridae. A summary of 19 family-group names is provided.

Nomenclature, generic names, gender, derivation, Hymenoptera, Chalcidoidea, Mymaridae, Mymarommatidae, worldwide

INTRODUCTION

I am pleased to dedicate this paper to Zdeněk Bouček. I first met Zdeněk in 1978 while visiting The Natural History Museum, London, to have some specimens of Chalcidoidea identified for a biological control of weeds project. At the time I was also considering further studies in systematics. I was interested in Chalcidoidea, particularly Mymaridae and Chalcididae, but was unsure of which group to choose for study. When I asked Zdeněk about it he suggested that Mymaridae was the better group to study because “there were many new discoveries to be made there compared to Chalcididae”. I followed his advice and, despite my frustration with their small size and taxonomic complexity, I am still working on them and continue to make many new discoveries, as he predicted. Over the years I got to know Zdeněk much better and I greatly respect his knowledge of languages.

Most of the genus-group names listed below are derived from ancient Greek and latinized in accordance with the ICZN (1999). Authors of old often had a good working knowledge of Latin and Greek but this is less frequently so today, at least in North America. Other languages are now also used to name taxa. The meaning of the names often reflect some morphological feature of the taxon or the location or habitat in which the taxon was collected. About 30 of the taxa are named after individual persons of note or of importance to the describer. Because the meaning of a name may help one to remember a taxon better, often by highlighting some supposedly distinctive feature, I attempted to determine the derivation for all the genus-group names of Mymaridae. Unfortunately, relatively few authors gave the derivation of the names they coined so my explanations are sometimes assumptions based on my knowledge of the genera themselves. In a few cases, the author's reason for proposing the name remains a mystery. Where the author gave the original Greek word with a different spelling from that given here, I also give his spelling and the citation. Dalla Torre (1898) is a good source of information for the Greek spelling of 20 nominal genera of Mymaridae

(then classified as Mymarinae in the Proctotrupidae). Brown (1956) is an indispensable reference for determining the meaning of Latin and Greek words. Hopper (1959) was also a useful source for checking some Greek spellings. Article 30 of the International Commission of Zoological Nomenclature (ICZN 1999) is followed, where applicable, for genus group names. Only the original Greek word(s) from which the scientific names were derived are given, not the entire Greek spelling of the name. Names in bold italics are currently recognized as valid genera; the remainder are currently treated as synonyms.

I compiled and checked my list of names and references independently from Noyes (2002) but then checked them against his database for omissions and discrepancies. A total of 181 genus-group names are listed for the Mymaridae, excluding homonyms, unjustified emendations, unnecessary replacement names, and any misspellings I found, which are listed separately. About 40 % of the genus-group names are subjective synonyms, partly reflecting the difficult taxonomy and changing concepts in the family but also the very incomplete world knowledge that most workers had when describing “new” genera. The Mymarommatidae includes six generic names; all but one are currently treated as synonyms. Family group names applied to the Mymaridae and Mymarommatidae are listed separately.

SYSTEMATICS

Genus group names of Mymaridae

- Acanthomymar* Subba Rao, 1970: 667. Neuter, *acantha* (ἄκανθα) = thorn + *Mymar*. Referring to the thick, blunt spines on the forewing venation, antennae, head, thorax and legs. Syn. with *Polynema* by Huber (2003).
- Acomopolynema* Ogloblin, 1946: 286.** Neuter, *acme* (ἀκμή) = apex, peak, point, edge + *Polynema*. Probably referring to the V-shaped medial carinae on the propodeum.
- Acmotemnus* Noyes et Valentine, 1989: 20.** Masculine, *acme* (ἀκμή) = apex, peak, point, edge + *temno* (τέμνω) = cut, divide. Referring to the clear, oblique hairless line on the forewing that arises at the apex of the venation and appears to divide the wing in two.
- Agalmopolynema* Ogloblin, 1960a: 2.** Neuter, *agalma* (ἄγαλμα) = glory, delight, honor + *Polynema*. Perhaps referring to the ochreous yellow body colour or perhaps to Ogloblin's delight at discovering a species that seemed to represent a new group. Subgenus of *Barypolynema*. Raised to generic status by Fidalgo (1988).
- Agonatocerus* Girault, 1913b: 276. Masculine, *a-* (ἀ-) = not + *Gonatocerus*. Close to *Gonatocerus* but not the same. Syn. with *Gonatocerus* by Girault (1915).
- Alalinda* Huber [in Huber et Lin], 1999: 33.** Feminine, *ala* (Spanish) = wing + *linda* (Spanish) = pretty. Referring to the patterned forewing. Subgenus of *Camptopteroides*.
- Alaptus* Westwood, 1839: 79.** Masculine, *aaptos* (ἄαπτος) = untouchable [Dalla Torre (1898) gives two other derivations, both likely incorrect, given their meaning, namely, “not to lap” and “to pillage”, respectively]. Referring to the minute body size. Westwood placed an “l” after the second letter, probably for ease of pronunciation.
- Allanagrus* Noyes et Valentine, 1989: 22.** Masculine, *allos* (ἄλλος) = other, different + *Anagrus*. Similar to *Anagrus* but different.
- Allarescon* Noyes et Valentine, 1989: 23.** Neuter, *allos* (ἄλλος) = other, different + *Arescon*. Similar to *Arescon* but different.
- Anagrella* Bakkendorf, 1962: 372.** Feminine, *Anagrus* + *-ella* (diminutive suffix) = little. A small *Anagrus*. Syn. with *Anagrus* by Viggiani (1970). Currently treated as a subgenus by Chiappini et al. (1996).
- Anagroidea* Girault, 1915: 164.** Feminine, *Anagrus* + *eidos* (εἶδος) = shape, form, resembling, like. In the form of *Anagrus*.
- Anagrus* Haliday, 1833: 346.** Masculine, *ana* (ἀνά) = along, over, above + *agros* (ἀγρός) = field, land. Species of *Anagrus* are commonly collected in open land such as fields.
- Anaphes* Haliday, 1833: 346.** Masculine (not neuter as stated in China, 1965), *Anaphes* (ἀναφής) = impalpable. Referring to the small body size.
- Anaphoidea* Girault, 1909: 167.** Feminine, *Anaphes* + *eidos* (εἶδος) = shape, form, resembling, like. In the form of *Anaphes*. Syn. with *Anaphes* by Debauche (1948).

Anneckia Subba Rao, 1970: 659. Feminine, proper name + -ia = pertaining to. Named after the South African entomologist David Annecke (1928–1981), who worked at the Agricultural and Technical Services, Pretoria.

Anthemiella Girault, 1911b: 185 [90]. Feminine, *Anthemus* [anthemus = flower, in ancient Greek] + -ella = little. Similar to *Anthemus* (Encyrtidae) because of the forewing shape but smaller in overall size. Syn. with *Paralleleptera* by Girault (1912); this, in turn, syn. with *Erythmelus* by Schauff (1984).

Antoniella Soyka, 1950: 121. Feminine, proper name + -ella = little. Named after Soyka's cousin, Miss Antonie Peitryga. Syn. with *Anaphes* by Graham (1982).

Apoxipteron Noyes et Valentine, 1989: 26. Neuter, apoxys (ἀποξύω) = to taper off + pteron (πτερόν) = wing. Referring to the narrow, tapered and pointed wings.

Arescon Walker, 1846: 50. Masculine, aresko (ἀρέσκω) = to please, give satisfaction. Referring to the pleasing appearance of the wasp, or perhaps the author's pleasure in discovering it.

Australomymar Girault, 1929b: 343. Neuter, australis = southern + *Mymar*. Named after the southern hemisphere country (Australia) in which the species was collected.

Austranaphes Ogloblin, 1962: 49. Masculine, australis = southern + *Anaphes*. Referring to the southern distribution of the species. Subgenus of *Anaphes*. Lowered to species group of *Anaphes* by Huber (1992).

Baburia Hedqvist, 2004. Feminine, Babur + -ia = pertaining to. Named after Z.M. Babur (1483–1530), founder of the Mughal dynasty in India.

Bakkendorfia Mathot, 1966: 227. Feminine, proper name + -ia = pertaining to. Named after the Danish entomologist Osvold Bakkendorf (1893–1972), who worked at the Zoological Museum, Copenhagen.

Barypolynema Ogloblin, 1946: 282. Neuter, barys (βᾶρὺς) = heavy + *Polynema*. Referring to the thickset appearance of the body. Syn. with *Polynema* by Schauff (1984).

Borneomymar Huber, 2002: 45. Neuter, proper name + *Mymar*. Named after the island (Borneo) where the type species was collected.

Boudiennyia Girault, 1937: 2. Feminine, proper name + -ia = pertaining to. Named after Sergey M. Budyonnyi (1883–1973), a commander of bolshevik cavalry troops in the Russian civil war (1917–1924).

Bruchomymar Ogloblin, 1939: 218. Feminine, proper name + *Mymar*. Named after the Argentinian (originally German) entomologist Carlos Bruch (1869–1943), who worked at the Natural History Museum and University of La Plata.

Caenomymar Yoshimoto, 1990: 49. Neuter, kainos (καινός) = recent, new + *Mymar*. Referring to its status as a new genus from the New World.

Callodicopus Ogloblin, 1955b: 377. Masculine, kalos (κάλλος) = beauty + *Dicopus*. Presumably referring to the more beautiful appearance compared to *Dicopus*.

Camptoptera Förster, 1856: 116. Feminine, kamptos (καμπτός) [χαμπτός in Förster (1856)] = bent, curved + pteron (πτερόν) = wing. Referring to the curved forewing.

Camptopteroides Viggiani, 1974a: 3. Feminine, *Camptoptera* + eidos (εἶδος) = shape, form, resembling, like. In the form of *Camptoptera*.

Caraphractus Walker, 1846: 50. Masculine, kara (κάρᾱ) = head, top + phraktos (φρακτός) = fenced in. Perhaps referring to the distinct trabeculae that border the vertex, thus enclosing it.

Carpenteriana Yoshimoto, 1975: 510. Feminine, proper name + -ana = belonging to, pertaining to (Latin adjectival suffix -anus, -a, -um). Named after the American palaeoentomologist Frank Carpenter (1902–1994), who worked at the Museum of Comparative Zoology, Cambridge, Massachusetts.

Ceratanaphes Noyes et Valentine, 1989: 29. Masculine, keras (κέρας) = horn + *Anaphes*. Referring to the forward prolongation of the face.

Chaetomymar Ogloblin, 1946: 277. Neuter, chaete (χαίτη) = long hair, mane + *Mymar*. Referring to the very long mesosomal setae.

Chromodicopus Ogloblin, 1955b: 390. Masculine, chroma (χρῶμα) = colour + *Dicopus*. Referring to the coloured funicle segments and the similarity to *Dicopus*. Syn. with *Dicopomorpha* by Yoshimoto (1990).

Chrysotonus Mathot, 1966: 224. Masculine, chrysos (χρῑσός) = gold + *Ooctonus*. Referring to the yellow body colour and resemblance with *Ooctonus*.

Cleruchus Enock, 1909: 453. Masculine, klerikos (κληρικός) = priest, cleric. Presumably referring to the uniform grey colour.

Clinomymar Kieffer, 1913a: 100. Neuter, klino (κλίνω) = to slope + *Mymar*. Referring to the gaster sloping upward relative to the mesosoma. This was probably an artifact of death in the type specimen (which may be lost). Syn. with *Anaphes* by Debauche (1949), perhaps following Ogloblin (1935b) who suggested *Clinomymar* might be a subgenus of *Anaphes*.

Cnecomymar Ogloblin, 1963: 65. Neuter, knekos (κνηκός)[χνηχος in Ogloblin (1963)] = pale yellow + *Mymar*. Referring to the yellow body colour.

Congolia Ghesquière, 1942: 320. Feminine, proper name + -ia = pertaining to. Named after the country (Congo) in which the species was collected. Syn. with *Camptoptera* by Debauche (1949).

Cosmocomoidea Howard, 1908: 68. Feminine, *Cosmocoma* + eidos (εἶδος) = shape, form, resembling, like. In the form of *Cosmocoma* (see derivation below). Syn. with *Gonatocerus* by Bouček & Graham (1972).

***Cremnomymar* Ogloblin, 1952: 120.** Neuter, kremnos (κρημνός) [κρεμνός = suspended, in Ogloblin (1952)] = precipice, overhanging wall + *Mymar*. Referring to the prominent, overhanging lateral carinae on the propodeum.

***Cybomymar* Noyes et Valentine, 1989: 31.** Neuter, kybo (κύβος) = cube + *Mymar*. Referring to the box-like mesosoma.

Dahmsia Doutt, 1975: 254. Feminine, proper name + -ia. Named after the Australian taxonomist Edward Dahms (1938–), a curator of insects at the Queensland Museum, Brisbane. Syn. with *Anagroidea* by Noyes & Valentine (1989).

Decamymar Annecke, 1961: 68. Neuter, deka (δέκα) = ten + *Mymar*. Referring to the 10-segmented antenna of the female. Syn. with *Calloodicopus* by Huber & Lin (1999).

Decarthrus Debauche, 1949: 21. Masculine, deka (δέκα) = ten + arthros (ἄρθρον) = joint. Referring to the 10-segmented antenna of the female. Syn. with *Gahanopsis* by Annecke & Doutt (1961).

***Dicopomorpha* Ogloblin, 1955b: 387.** Feminine, *Dicopus* + morphe (μορφή) = shape, form. Referring to the similarity with *Dicopus*.

Dicopulus Ogloblin, 1955b: 394. Masculine, *Dicopus* + -ulus = little (diminutive suffix). Resembling a small *Dicopus*. Syn. with *Dicopomorpha* by Yoshimoto (1990).

***Dicopus* Enock, 1909: 455.** Masculine, di- (δι-) = two, double + kope (κῶπη) = oar. The forewing is oar-shaped, hence 'two-oared'.

Doriclytus Förster, 1847: 226. Masculine, dory (δῶρυ) = spear + klytos (κλῦτός) = renowned, glorious. Referring to the very long ovipositor. Syn. with *Polynema* by Schauff (1984).

***Dorya* Noyes et Valentine, 1989: 33.** Neuter, dory (δῶρυ) = spear. Referring to the long, spear-shaped clava of the female.

***Dorypolynema* Hayat et Anis, 1999b: 318.** Neuter, dory (δῶρυ) = spear + *Polynema*. Referring to the long, exerted ovipositor. Subgenus of *Polynema*.

Douttiella Annecke, 1961: 71. Feminine, proper name + -ella = little. Named after the American entomologist Richard Doutt (1916–), who worked at the University of California, Berkeley. Syn. with *Cleruchus* by Noyes & Valentine (1989).

Enaesius Enock, 1909: 456. Masculine, enaisios (ἐναίσιος) = in good sense. [Also, name of a Greek bullfighter who changed his name to Enasius when he arrived in Rome. Other historical or mythical persons were also named Enasius]. Treated as subgenus of *Erythmelus* by Debauche (1948). Syn. (implied) with *Erythmelus* by Graham (1982). Relevance unknown.

***Enneagmus* Yoshimoto, 1975: 512.** Masculine, ennea (ἐννέα) = nine + agmos (ἄγμος) = break, fracture [perhaps should correctly have been agmatos = fragment]. Referring to the apparently 9-segmented antennae. I examined the holotype and a digital image of it. I found that despite the 3-segmented tarsi *Enneagmus* definitely belongs to the Mymaridae because of the widely spaced toruli and antennal structure, the funicle 4-segmented, without anelli, and clava 1-segmented [not 3-segmented as stated in original description].

***Entrichopteris* Yoshimoto, 1990: 62.** Masculine, entrichos (ἐντριχος) = hairy + pteron (πτερόν) = wing. Referring to the long forewing hairs.

***Eofoersteria* Mathot, 1966: 231.** Feminine, eo (ἔως) = early, east + proper name + -ia = pertaining to. Named after the German entomologist Arnold Förster (1810–1884), who worked in a high school in Aachen.

Eomymar Perkins, 1912: 26. Neuter, eo (ἔως) = early, east + *Mymar*. Perhaps referring to the collection locality (Java) which is in the far east relative to Hawaii, where Perkins was based. Syn. with *Camptoptera* by Huber & Lin (1999).

***Erdosiella* Soyka, 1956: 16.** Feminine, proper name + -ella = little. Named after the Hungarian priest József Erdős (1900–1971), who worked on Chalcidoidea in Tompa.

Erythmellus Viggiani et Jesu, 1985: 487. Masculine, erythros (ἐρυθρός) = red + melos (μέλος) = limb + -ellus = little. A small *Erythmelus*. Syn. with *Erythmelus* by Triapitsyn (2003).

***Erythmelus* Enock, 1909: 454.** Masculine, erythros (ἐρυθρός) = red + melos (μέλος) = limb. The type species does not have red limbs; they are brownish or yellowish, but some killing agents may render the limbs reddish (colour lost upon slide-mounting).

***Eubroncus* Yoshimoto, Kozlov et Trjapitzin, 1972: 879.** Masculine, eu (εὖ) = true + bronchos (βρόγχος) = windpipe. Referring to the long, thin, downward-projecting mandibles, in lateral view resembling a tube projecting from the mouth.

***Ecleruchus* Ogloblin, 1940: 600.** Masculine, eu (εὖ) = true + *Cleruchus*. Referring to the close similarity to *Cleruchus*.

Eustephanodes Ogloblin, 1967: 194. Masculine, eu (εὐ) = true + *Stephanodes*. Referring to the close similarity to *Stephanodes*. Syn. with *Stephanodes* by Yoshimoto (1990).

***Eustochomorpha* Girault, 1915: 155.** Feminine, *Eustochus* + morpha (μορφή) = shape, form. Referring to the 2-segmented clava, as in *Eustochus*.

***Eustochus* Haliday, 1833: 349.** Masculine, eu (εὐ) = true + stochos (στόχος) = aim, shot. Probably referring to the long, projecting ovipositor ('well-aimed'). Dalla Torre (1898) gave the meaning as very capable (bene potens).

Eutriche Nees, 1834: 196. Masculine, eu (εὐ) = true + thrix (θρίξ) [genitive: trichos (τρίχος)] = hair. Referring to the strongly and beautifully fringed wings [ob alas valde et pulchre ciliatas (Nees, 1834)]. Syn. (implied) with *Polynema* by Förster (1847).

Ferrierella Soyka, 1946: 182. Feminine, proper name + -ella = little. Named after the Swiss entomologist Charles Ferrière (1888–1979), who worked at the Muséum d'Histoire Naturelle, Geneva. Syn. with *Anaphes* by Annecke & Doutt (1961).

Flabrinus Rondani, 1877: 180. Masculine, flabra = "puff of air" + -inus = belonging to, pertaining to (Latin suffix -inus). Referring to the ease with which the wasp is carried by wind. Syn. with *Anaphes* by Bouček (1974).

***Floripolynema* Triapitsyn et Berezovskiy, 2002: 616.** Neuter, proper name (abbreviation) + *Polynema*. Subgenus of *Kalopolynema*.

***Formicomymar* Yoshimoto, 1990: 80.** Neuter, formica = ant + *Mymar*. Referring to the ant-like appearance.

Furmekiella Soyka, 1946: 184. Feminine, proper name + -ella = little. Named after the Austrian entomologist Leopold Fulmek (1883–1969) who worked at the Naturhistorisches Museum, Vienna. Syn. (implied) with *Anaphes* by Graham (1982).

***Gahanopsis* Ogloblin, 1946: 286.** Feminine, proper name + -opsis (ὄψις) = appearance, likeness, sight. Named after the American entomologist Arthur Gahan (1880–1960), who worked at the National Museum of Natural History, Washington, DC. Subgenus of *Lymaenon*. Given generic status by Annecke & Doutt (1961).

***Ganomymar* De Santis, 1972.** Neuter, ganos (γάνος) = brightness + *Mymar*. Perhaps referring to the pale yellow body and white clava of the type species. De Santis translated ganos as "clarity", perhaps to suggest that the genus was clearly a Mymaridae despite its short wings.

Gastrogonatocerus Ogloblin, 1935b: 65. Masculine, gastros (γαστήρ) = stomach, venter + *Gonatocerus*. Referring to the gaster extending forward under the mesosoma. Syn. (implied) with *Lymaenon* by Viggiani (1969).

Gonatoceroidea Girault, 1913c: 255. Masculine, *Gonatocerus* + eidos (εἶδος) = shape, form, resembling, like. In the form of *Gonatocerus*. Syn. with *Gonatocerus* by Girault (1915).

***Gonatocerus* Nees, 1834: 192.** Masculine, genu, gonatos (γονῦ, γόνατος) = knee + keras (κέρας) = horn. Referring to the elbowed (knee-like) antenna, which is double geniculate in the female [ob antennas in medio refractas (Nees 1834)].

Grangeriella Soyka, 1956: 17. Feminine, proper name + -ella = little. Named after the French lawyer Charles Granger (deceased 1972), an amateur hymenopterist at the Muséum national d'histoire naturelle, Paris. Syn. with *Acmopolynema* by Hayat & Anis (1999a).

Hadromymar Yoshimoto, 1990: 30. Neuter, hadros (ἄδρως) = stout, bulky + *Mymar*. Referring to the thickset, compact appearance. Syn. with *Stephanocampta* by Huber & Lin (1999).

***Haplochaeta* Noyes et Valentine, 1989: 39.** Feminine, haplo (ἁπλός) = simple, plain + chaeta (χαίτη) = long hair. Referring to the very long distal macrochaeta on the marginal vein.

Herulia Hedqvist, 1962: 103. Feminine, proper name + -ia = pertaining to. Named after the Heruler, a tribe of people that settled in the province of Blekinge, Sweden, where the type specimen was collected. Syn. with *Macrocamptoptera* by Huber & Lin (1999).

***Himopolynema* Taguchi, 1977: 137.** Neuter, hima (εἶμα) = dress, garment + *Polynema*. Perhaps referring to the scutellum covering the metanotum, and its similarity to *Polynema*.

Hofenederia Soyka, 1946: 183. Feminine, proper name + -ia = pertaining to. Named after the Austrian priest Karl Hofeneder (1878–1951), who worked at a teachers training college, Innsbruck. Syn. (implied) with *Anaphes* by Yoshimoto (1990).

***Idiocentrus* Gahan, 1927: 35.** Masculine, idios (ἰδιος) = peculiar + kentron (κέντρον) = spike, point. Referring to the elongate ovipositor that extends under the body and past the head.

***Ischiodasys* Noyes et Valentine, 1989: 37.** Masculine, ischion (ἰσχίον) = hip + dasys (δασύς) = hairy. Referring to the dense tuft of setae dorsally on the hind coxa.

***Kalopolynema* Ogloblin, 1960a: 3.** Neuter, kalos (κάλος) = beauty + *Polynema*. Presumably referring to the pretty body colour (ochreous yellow), unusual for a *Polynema*.

***Kikiki* Huber et Beardsley, 2000: 66.** Feminine, kikiki (Hawaiian) = tiny bit. Referring to the very small body size.

***Krokella* Huber, 1993: 349.** Feminine, arbitrary combination of letters + -ella = little. Referring to the large, crocodile-like mandibles of the male.

- Kubja Subba Rao, 1984: 251.** Feminine, kubja (Sanskrit) = dwarf, stumpy. No gender was specified so Article 30.2.4 (ICZN 1999) applies. Referring to the extremely short body.
- Leimacis Förster, 1847: 208.** Feminine, leimax (λεῖμαξ) [λεῖμαξις in Dalla Torre (1898)] = meadow. Presumably referring to the collection location, i.e., in fields or pastures. Syn. with *Arescon* by Förster (1856).
- Litus Haliday, 1833: 345.** Masculine, litos (λίτος) = plain, simple, unadorned, pure. Perhaps referring to the smooth, shiny metasoma.
- Lymaenon Walker, 1846: 50.** Masculine, lymeon (λῦμεών) = destroyer. Presumably referring to the parasitoid way of life that kills its host. Syn. with *Gonatocerus* by Förster (1856).
- Macalpinia Yoshimoto, 1975: 527.** Feminine, proper name + -ia = pertaining to. Named after the Canadian entomologist Frank Macalpine (1922–) who collected many amber fossils and worked at the Canadian National Collection of Insects, Ottawa.
- Macrocamptoptera Girault, 1910: 239.** Feminine, makros (μακρός) = long + *Camptoptera*. Referring to the large size compared to *Camptoptera*.
- Maidliella Soyka, 1946: 178.** Feminine, proper name + -ella = little. Named after the Austrian entomologist Franz Maidl (1887–1951), who worked at the Naturhistorisches Museum, Vienna. Syn. with *Polynema* by Annecke & Doutt (1961).
- Malfattia Meunier, 1901: 287.** Feminine, proper name + -ia = pertaining to. Named after the Italian entomologist Giovanni Malfatti, who worked for a few years at the Museo Civico di Storia Naturale, Milan. Questionable synonymy under *Litus* by Ashmead (1904) and Schmiedeknecht (1909), but see Annecke & Doutt (1961) and Doutt (1973) for contrary opinion.
- Mariella Soyka, 1950: 123.** Feminine, proper name + -ella = little. Named after Miss Mariella Ferrière, daughter of the Swiss hymenopterist Charles Ferrière.
- Masonana Yoshimoto, 1990: 63.** Feminine, proper name + -ana = belonging to, pertaining to (Latin suffix -anus, -a, -um). Named after the Canadian taxonomist William Mason (1921–1989), who worked at the Canadian National Collection of Insects, Ottawa. Syn. with *Stephanodes* by Huber & Lin (1999).
- Metaltapus Malenotti, 1917: 339.** Masculine, meta (μετά) = near, between, among + *Alaptus*. Close to *Alaptus*. Syn. with *Alaptus* by Debauche (1949).
- Mimalaptus Noyes et Valentine, 1989: 38.** Masculine, mimos (μίμος) = imitator + *Alaptus*. Similar to *Alaptus*.
- Mymar Curtis, 1829: 112.** Neuter, mymar (μῦμαρ) [Aeolian dialect for momar (μῶμος)]. Poetic for momos (μῶμος) = blame, reproach, disgrace. Probably named for the peculiar elongate appendages, especially the oar-like forewing and thread-like hindwing, that makes *Mymar* species so unlike most other Mymaridae. Probably unwittingly, Curtis provided a second, very apt, hidden meaning because the Aeolian spelling is from a peripatetic Greek tribe (hence named after Aeolus, the mythical god of winds) and could therefore refer to the fact that mymarids are easily transported by wind.
- Mymarilla Westwood, 1879: 585.** Feminine [not neuter as stated in China (1965); article 30.1.3 in ICZN (1999)]. *Mymar* + -illa (diminutive suffix). Rather like a *Mymar*.
- Myrmecomymar Yoshimoto, 1990: 28.** Neuter, myrmex (μύρμηξ) = ant + *Mymar*. The wingless female resembles an ant.
- Narayanella Subba Rao, 1976: 352.** Feminine, proper name + -ella = little. Named after the Indian taxonomist, E. S. Narayan (1904–1990), who worked at the Indian Agricultural Research Institute, New Dehli. Replacement name for *Narayana* Subba Rao, 1976, non *Narayana* Distant, 1906 – Heteroptera).
- Neolitus Ogloblin, 1935a: 60.** Masculine, neos (νέος) = new + *Litus*. Similar to *Litus* and described from the New World. Syn. with *Litus* by Triapitsyn & Berezovskiy (2004).
- Neomymar Crawford, 1913: 351.** Neuter, neos (νέος) = new + *Mymar*. Similar to *Mymar* and described from the New World.
- Neonarayanella Husain and Farooqi, 1996: 83.** Feminine, neos (νέος) = new + *Narayanella*. Similar to *Narayanella* and described later than *Narayanella*. Syn. with *Acmopolynema* by Hayat & Anis (1999a).
- Neostethynium Ogloblin, 1964: 106.** Neuter, neos (νέος) = new + *Stethynium*. Similar to *Stethynium* because of the 3-segmented clava, and described from the New World. Raised to genus by Yoshimoto (1990).
- Neserythmelus Noyes et Valentine, 1989: 40.** Masculine, nesos (νήσος) = island + *Erythmelus*. Described from the island of New Zealand, and similar to *Erythmelus*.
- Nesetaerus Doutt, 1955: 12.** Masculine, nesos (νήσος) = island + etaerus (ἑταῖρος) = companion, comrade. Described from Truk Island (Micronesia), as an 'island companion' when Doutt was collecting there.
- Nesomymar Valentine, 1971: 329.** Neuter, nesos (νήσος) = island + *Mymar*. Described from Campbell I. (South of New Zealand).
- Nesopatasson Valentine, 1971: 327.** Masculine, nesos (νήσος) = island + *Patasson*. Described from Auckland Is. (South of New Zealand), and similar to *Patasson*.

Nesopolynema Ogloblin, 1952: 132. Neuter, nesos (νήσος) = island + *Polynema*. Described from Robinson Crusoe I. (Juan Fernández Is.), and similar to *Polynema*.

Neurotes Enoch, 1914: 134. Neuter, nevron (νεῦρον) = nerve. Referring to the long forewing venation. Syn. with *Arescon* by De Santis (1967).

Notomymar Doutt et Yoshimoto, 1970: 293. Neuter, notos (νότος) = south + *Mymar*. Referring to the very southern collecting locality (South Georgia I.).

Notopolynema Ogloblin, 1960b: 77. Neuter, notos (νότος) = south + *Polynema*. Referring presumably to the southern collecting locality (Argentina). Subgenus of *Barypolynema* (see under *Barypolynema*).

Novickyella Soyka, 1946: 179. Feminine, proper name + -ella = little. Named after the Czech/Polish forest engineer and entomologist Światosław (Svatoslav) Nowicky (= Novicky, Novitzky) (1902–1980), who worked lastly at the Naturhistorisches Museum, Wien. Syn. with *Polynema* by Debauche (1949).

Omyomymar Schauf, 1983: 544. Neuter, omyo = arbitrary combination of letters + *Mymar*. Reflecting the author's surprise (oh my!) at discovering a new mymarid genus in North America.

Oncomymar Ogloblin, 1957: 414. Neuter, onkos (ὄγκος) [ογκος in Ogloblin] = hook, barb, tubercle + *Mymar*. Presumably referring to the small setiferous tubercles laterally on the propodeum.

Ooconus Haliday, 1833: 343. Masculine, oon (ὄν) = egg + ktonos (κτόνος) = killer, murderer. The species parasitize, and therefore kill, insect eggs (as do all Mymaridae).

Oophilus Enoch, 1909: 458. Masculine, oon (ὄν) = egg + philos (φίλος) = friend. Refers to the egg-parasitic way of life. Syn. with *Gonatocerus* by Girault (1911a).

Palaeoneura Waterhouse, 1915: 537. Feminine, palaeos (παλαιός) = ancient + nevron (νεῦρον) = nerve. Referring to the apparently primitive venation.

Palaeopatasson Witsack, 1986: 266. Masculine, palaeos (παλαιός) = ancient + *Patasson*. Referring to the age of the (extinct) genus.

Panthus Walker, 1846: 50. Masculine, proper name (mythological – Roman priest of Apollo). Syn. with *Anaphes* by Graham (1982).

Paracleruchus Yoshimoto, 1971: 1079. Masculine, para (παρά) = beside + *Cleruchus*. Close to *Cleruchus*. Syn. with *Cleruchus* by Viggiani (1974b).

Paracmotemnus Noyes et Valentine, 1989: 42. Masculine, para (παρά) = beside + *Acotemnus*. Similar to *Acotemnus* in having a long forewing venation.

Parallelaptera Enoch, 1909: 454. Feminine, parallelos (παράλληλος) = parallel + pteron (πτερόν) = wing. Referring to the parallel margins of the forewing. Currently treated as a subgenus of *Erythmelus* (Triapitsyn 2003).

Paranagroidea Noyes et Valentine, 1989: 44. Neuter, para (παρά) = beside + *Anagroidea*. Similar to *Anagroidea* based on the strong body reticulation and double-geniculate antenna. Syn. of *Camptopteroides* by Huber & Lin (1999).

Paranagrus Perkins, 1905: 199. Masculine, para (παρά) = beside + *Anagrus*. Close to *Anagrus*. Syn. with *Anagrus* by Bakkendorf (1926). Currently treated as a subgenus of *Anagrus* (Chiappini et al. 1996).

Paranaphoidea Girault, 1913d: 115. Neuter, para (παρά) = beside + *Anaphoidea*. Resembling *Anaphoidea* based on the 2-segmented clava of the female.

Parapolynema Fidalgo, 1982: 97. Neuter, para (παρά) = beside + *Polynema*. Close to *Polynema*.

Parvulinus Mercet, 1912: 332. Masculine, parvulus = very small. Referring to the minute size. Syn. with *Alaptus* by Girault (1913a).

Patasson Walker, 1846: viii [errata and addenda]. Masculine, patasso (πάτασσω) = to beat, strike. Probably referring to the parasitic habit. Syn. with *Anaphes* by Huber (1992).

Platyfrons Yoshimoto, 1990: 79. Masculine, platys (πλάτυς) = flat + frons = front, forehead. Referring to the flattened face.

Platypatasson Ogloblin, 1946: 293. Masculine, platys (πλάτυς) = flat + *Patasson*. Referring to the very flattened body and similarity with *Patasson* in the 2-segmented clava. Syn. with *Platystethynium* by Donev and Huber (2002).

Platypolynema Ogloblin, 1960a: 7. Neuter, platys (πλάτυς) = flat + *Polynema*. Referring to the very flattened body, and the similarity with *Polynema*.

Platystethynium Ogloblin, 1946: 290. Neuter, platys (πλάτυς) = flat + *Stethynium*. Referring to the very flattened body and the similarity with *Stethynium* in the 3-segmented clava.

Polynema Haliday, 1833: 347. Neuter, polys (πολύς) = many + nema (νήμα) = thread. Presumably referring to the many long setae forming the fringe of each wing.

Polynemoidea Girault, 1913d: 116. Neuter, *Polynema* + eidos (εἶδος) = shape, form, resembling, like. Similar to *Polynema*.

Polynemula Ogloblin, 1967: 190. Feminine, *Polynema* + -ulus (diminutive suffix) = rather, somewhat. Similar to a small *Polynema*.

Prionaphes Hincks, 1961: 159. Masculine, prion (πρῶν) = saw, serrated + *Anaphes*. Named after its host, *Prionoplus* (Cerambycidae).

Protooctonus Yoshimoto, 1975: 511. Masculine, protos (πρῶτος) = first + *Ooctonus*. Referring to the fossil's age, and the 7-segmented funicle (supposedly close to *Ooctonus*, which has eight segments).

Pseudanaphes Noyes et Valentine, 1989: 47. Masculine, pseudēs (ψευδής) = false + *Anaphes*. Similar to *Anaphes* but not the same.

Pseudocleruchus Donev et Huber, 2002: 118. Masculine, pseudēs (ψευδής) = false + *Cleruchus*. Similar to *Cleruchus* but not the same.

Pteratomus Packard, 1864: 137. Masculine, pteron (πτερόν) = wing + atomus = atom. Referring to the size — “a winged atom”. Syn. with *Anagrus* by Annecke & Doutt (1961).

Pterolinononyktera Maláč, 1943: 51. Feminine, pteron (πτερόν) = wing + linon (λινόν) = flaxen thread + onyx (ὄνυξ) = nail. Referring to the peculiar wings, the hind wing being thread or nail-like. Syn. with *Mymar* by Annecke & Doutt (1961).

Ptilomymar Annecke et Doutt, 1961: 24. Neuter, ptilon (πίλον) = feather + *Mymar*. Referring to the branched, feather-like propodeal seta.

Rachistus Förster, 1847: 203. Masculine, rhachis (ῥάχις) [ῥάχιστός = dissectus (cut up) in Dalla Torre (1898)] = spine, ridge, or keel. Referring to the antenna that is divided into many segments. Syn. of *Gonatocerus* by Förster (1856).

Restisoma Yoshimoto, 1990: 68. Neuter, restis = rope + soma (σῶμα) = body. Referring to the body sculpture that resembles a coarse rope made of plant fibres.

Rhila Donev, 1989: 79. Feminine, proper name. No gender was specified so Article 30.2.4 (ICZN 1999) applies. Named after the Rhila mountains, Bulgaria, where the species was collected. Syn. with *Macrocamptoptera* by Huber & Lin (1999).

Richteria Girault, 1920b: 2. Feminine, proper name + -ia = pertaining to. Perhaps named after the German entomologist Paul Richter (1841–1891).

Schizophragma Ogloblin, 1949: 345. Neuter, schistos (σχιστός) = divided + phragma (θράγμα) = wall. Referring to the mesophragma that is deeply notched at the apex.

Scleromymar Noyes et Valentine, 1989: 49. Neuter, skleros (σκληρός) = hard + *Mymar*. Referring to the well-sclerotized body.

Scolopsopterom Ogloblin, 1952: 127. Neuter, skolops (σκόλοψ) = pointed + pteron (πτερόν) = wing. Referring to the apically pointed forewing.

Seleneaus Waterhouse, 1915: 536. Masculine, selene, selenis (σεληναῖος) = moon. Also, lit by the moon. Perhaps referring to the crescent-shaped infuscation behind the forewing venation. Syn. with *Polynemoidea* by Doutt (1973).

Sphecomircus Haliday [in Walker], 1846 [errata and addenda]. Masculine, sphex (σφήξ) = wasp + mikros (μικρός) = small. Referring to the small body size. Syn. with *Ooctonus* by Kryger (1934).

Sphegilla Debauche, 1948: 62. Feminine, sphex (σφήξ) = wasp + -illa = little. Referring to the small body size. Syn. with *Camptoptera* by Yoshimoto (1990).

Stammeriella Soyka, 1950: 120. Feminine, proper name + -ella = little. Named after the German zoologist H.-J. Stammer (1899–1968) who worked at the Zoological Institute, University of Erlangen. Syn. with *Anaphes* by Annecke & Doutt (1961).

Staneria Mathot, 1966: 214. Feminine, proper name + -ia = pertaining to. Named after the Belgian botanist P. Staner (1901–1984), who worked at the University of Louvain. Syn. with *Camptoptera* by Huber & Lin (1999).

Steganogaster Noyes et Valentine, 1989: 51. Neuter, steganos (στεγανός) = sheathed + gastros (γαστρός) = stomach. Referring to the translucent, reticulate membrane covering most of the gaster.

Stenomymar Ogloblin, 1967: 184. Neuter, stenosis (στενός) = narrow + *Mymar*. Referring to the long, slender body. Syn. with *Erdosiella* by Yoshimoto (1990).

Stenopteromymar Ferrière, 1952: 41. Neuter, stenosis (στενός) = narrow + pteron (πτερόν) = wing + *Mymar*. Referring to the extremely slender wings. Syn. with *Cleruchus* by Viggiani (1974b).

Stephanocampta Mathot, 1966: 219. Feminine, stephanos (στέφανος) = wreath + kamptos (κάμπτω) = to bend. Referring to the translucent, membranous collar surrounding the gastral petiole, and the curved forewing.

Stephanodes Enock, 1909: 457. Masculine, stephanodes (στεφάνωδης) = wreathed, wreath-like. Perhaps referring to the distinct, shallow depressions outside each ocellus, giving the appearance of a depressed wreath around the ocelli.

Stethynium Enock, 1909: 452. Neuter, stethos (στήθος) = breast + -ion (-έον) (diminutive suffix) = little. Perhaps referring to the two halves of the posterior scutellum that resemble a small pair of breasts.

Stichothrix Förster, 1856: 117. Feminine, stichos (στίχος) = line, row + thrix (θρίξ) = hair. Presumably referring to the single medial hair line on the forewing. Syn. with *Camptoptera* by Annecke & Doutt (1961).

Stomarotrum Yoshimoto, Kozlov et Trjapitzin, 1972: 881. Neuter, stoma (στόμα) = mouth + rostrum = beak, snout. Referring to the long, downward-projecting mandibles that appear to form a beak in lateral view. Syn. with *Eubroncus* by Triapitsyn & Huber (2000).

Synanaphes Soyka, 1946: 181. Masculine, syn- (σύν-) = together with + *Anaphes*. Close to *Anaphes*. Syn. with *Anaphes* by Annecke & Doutt (1961).

Tanaomymar Annecke et Doutt, 1961: 25. Neuter, tanaos (ταναός) = long, outstretched + *Mymar*. Referring to the very long mesosoma. Syn. with *Erdosiella* by Fidalgo (1992).

***Tanyostethium* Yoshimoto, 1990: 74.** Neuter, tany- (τάνυ-) = long + stethos (στήθος) = breast + -ion (-έον) = little. Referring to the long mesosoma.

Tarphypolynema Ogloblin, 1960b: 79. Neuter, tarphys (ταρφύς) = close, thick + *Polynema*. Subgenus of *Barypolynema* (see under *Barypolynema*).

***Tetrapolynema* Ogloblin, 1946: 279.** Neuter, tetra (τετρα) = four + *Polynema*. Probably referring to the four setae on the propodeum.

***Triadomerus* Yoshimoto, 1975: 508.** Masculine, trias (τρίας) = in threes + meros (μέρος) = part, portion. Referring to the 3-segmented clava of the female.

Valkerella Westwood, 1879: 584. Feminine, proper name + -ella. Named after Francis Walker (1809–1874), who worked at the Natural History Museum, London. Syn. (implied) of *Caraphractus* (not *Polynema*) by Schmiedeknecht (1909).

Wertanekiella Soyka, 1961: 87. Feminine, proper name + -ella = little. Named after the brothers Hans Wertanek in Vienna and Karl Wertanek in Bad Deutsch-Altenburg. Syn. with *Sphegilla* by Mathot (1969).

Xenomymar Crawford, 1913: 349. Neuter, xenos (ξένος) = stranger, guest + *Mymar*. Probably referring to the peculiar (long) forewing venation. Syn. with *Arescon* by Annecke and Doutt (1961).

Xenopolynema Ogloblin, 1960a: 9. Neuter, xenos (ξένος) = stranger, guest + *Polynema*. Probably referring to the peculiar thoracic structure. Ogloblin (1960a). Syn. with *Polynema* by Yoshimoto (1990).

***Yungaburra* Girault 1933: 5.** Feminine, proper name (probably Yidiny). Named after the locality (Yungaburra [probably derived from Janggaburru, Yidiny name for Queensland silver ash tree], Australia) where the species was collected. Subgenus of *Anaphes* (Huber 1992).

***Zelanaphes* Noyes et Valentine, 1989: 53.** Masculine, proper name (abbreviation) + *Anaphes*. Named after the country (New Zealand) in which the species was collected, and its similarity in some respects to *Anaphes*.

***Zemicamptoptera* Ogloblin et Annecke, 1961: 302.** Feminine, zemia (ζημία) = damage, loss + *Camptoptera*. Referring to the reduced number (loss) of antennal segments in the male compared to *Camptoptera sensu stricto*. Subgenus of *Camptoptera*.

Genus-group names of Mymaridae listed by author

Names in bold are genera or subgenera currently considered valid. Names **originally** proposed as subgenera are indicated as such.

Annecke (1961): *Decamymar*, *Douttiella*; Annecke & Doutt (1961): ***Ptilomymar***, *Tanaomymar*; Ashmead (1904): *Packardiella*; Bakkendorf (1962): ***Anagrella***; Crawford (1913): *Neomymar*, *Xenomymar*; Curtis (1829): ***Mymar***; Debauche (1948): *Sphegilla*; Debauche (1949): *Decarthrius*; De Santis (1972): ***Ganomymar***; Donev (1989): *Rhila*; Donev & Huber (2002): ***Pseudocleruchus***; Doutt (1955): ***Nesetaerus***; Doutt (1975): *Dahmsia*; Doutt & Yoshimoto (1970): ***Notomymar***. Enock (1909): ***Cleruchus***, ***Dicopus***, *Enaesus*, ***Erythmelus***, *Oophilus*, ***Parallelaptera***, ***Stephanodes***, ***Stethynium***; Enock (1914): *Neurotes*; Ferrière (1952): *Stenopteromymar*; Fidalgo (1982): ***Parapolynema***; Förster (1847): *Dorichlytus*, *Leimacis*, *Rachistus*; Förster (1856): ***Camptoptera***, *Stichothrix*; Gahan (1927): ***Idiocentrus***; Ghesquière (1942): *Congolia*; Girault (1909): *Anaphoidea*; Girault (1910): ***Macrocamptoptera***; Girault (1911b): *Anthemiella*; Girault (1913b): *Agonotocerus*; Girault (1913c): *Gonatoceroidea* (subgenus); Girault (1913d): ***Paranaphoidea***, ***Polynemoidea***; Girault (1915): ***Anagroidea***, ***Eustochomorpha***; Girault (1920b): ***Richteria***; Girault (1929b): *Australomymar*; Girault (1933): *Yungaburra*; Girault (1937): ***Boudiennia***; Haliday (1833): ***Anagrus***, ***Anaphes***, ***Eustochus***, ***Litus***, ***Ooctonus***, ***Polynema***; Haliday (in Walker) (1846): *Sphecomicrus*; Hayat & Anis (1999b): ***Dorypolynema*** (subgenus); Hedqvist (1962): *Herulia*; Hedqvist (2004): ***Baburia***; Hincks (1961): ***Prionaphes***; Howard (1908): *Cosmocomoidea*; Huber (1993): ***Krokella***; Huber (2002): ***Borneomymar***; Huber (in Huber & Lin) (1999): ***Alalinda*** (subgenus); Huber & Beardsley (2000): ***Kikiki***; Husain & Farooqi (1996): *Neonarayanella*; Kieffer (1913a): *Clinomymar*; Maláč (1943): *Pterolinononyktera*; Malenotti (1917): *Metaluptus*; Mathot (1966): ***Bakkendorfia***, ***Chrysoctonus***, ***Eofoersteria***, *Staneria*, ***Stephanocampta***; Mercet (1912): *Parvulinus*; Meunier (1901): ***Malfattia***; Nees (1834): *Eutriche*, ***Gonatocerus***; Noyes & Valentine (1989): ***Acmotemnus***, ***Allanagrus***, ***Allarescon***, ***Apoxypylon***, ***Ceratanaphes***, ***Cybomymar***, ***Dorya***, ***Haplochaeta***,

Ischiodasys, *Mimalaptus*, *Neserythmelus*, *Paracmotemnus*, *Paranagroidea*, *Pseudanaphes*, *Scleromymar*, *Steganogaster*, *Zelanaphes*; Ogloblin (1935a): *Neolitus*; Ogloblin (1935b): *Gastrogonatocerus* (subgenus); Ogloblin (1939): *Bruchomymar*; Ogloblin (1940): *Eucleruchus*; Ogloblin (1946): *Acmopolynema*, *Barypolynema*, *Chaetomymar*, *Gahanopsis* (subgenus), *Platypatasson*, *Platystethynium*, *Tetrapolynema*; Ogloblin (1949): *Schizophragma*; Ogloblin (1952): *Cremnomymar*, *Nesopolynema*, *Scolopsopteron*; Ogloblin (1955): *Callodicopus*, *Chromodicopus*, *Dicopomorpha*, *Dicopulus*. Ogloblin (1957): *Oncomymar*. Ogloblin (1960a): *Agalmopolynema* (subgenus), *Kalopolynema*, *Platypolynema*, *Xenopolynema* (subgenus); Ogloblin (1960b): *Notopolynema* (subgenus), *Tarphypolynema* (subgenus); Ogloblin (1962): *Austranaphes* (subgenus); Ogloblin (1963): *Cnecomymar*; Ogloblin (1964): *Neostethynium*; Ogloblin (1967): *Eustephanodes*, *Polyneumula*, *Stenomymar*; Ogloblin & Annecke (1961): *Zemicamptoptera* (subgenus); Packard (1864): *Pteratomus*; Perkins (1905): *Paranagrus*; Perkins (1912): *Eomymar*; Schauff (1983): *Omyomymar*; Rondani (1877): *Flabrinus*; Soyka (1946): *Ferrierella*, *Fulmekiella*, *Hofenederia*, *Maidliella*, *Novickyella*, *Synanaphes*; Soyka (1950): *Antoniella*, *Mariella*, *Stammeriella*; Soyka (1956): *Erdosiella*, *Grangeriella*; Soyka (1961): *Wertanekiella*; Subba Rao (1970): *Acanthomymar*, *Anneckia*; Subba Rao (1976): *Narayanela* (replacement name); Subba Rao (1984): *Kubja*; Taguchi (1977): *Himopolynema*; Triapitsyn & Beresovskiy (2002): *Floripolynema* (subgenus); Valentine (1971): *Nesomymar*, *Nesopatasson*; Viggiani (1974b): *Camptopteroides*; Viggiani & Jesu (1985): *Erythmellelus* (subgenus); Walker (1846): *Arescon*, *Caraphractus*, *Lymaenon*, *Panthus*, *Patasson*; Waterhouse (1915): *Palaeoneura*, *Selenaesus*; Westwood (1839): *Alaptus*; Westwood (1879): *Mymarilla*, *Valkerella*; Witsack (1986): *Palaeopatasson*; Yoshimoto (1971): *Paracleruchus*; Yoshimoto (1975) *Carpenteriana*, *Enneagmus*, *Macalpinia*, *Protooctonus*, *Triadomerus*; Yoshimoto (1990): *Caenomymar*, *Entrichopteris*, *Formicomymar*, *Hadromymar*, *Masonana*, *Myrmecomymar*, *Platyfrons*, *Restisoma*, *Tanyostethium*; Yoshimoto et al. (1972): *Eubroncus*, *Stomarostrum*.

Homonyms, unnecessary replacement names, unjustified emendations, and misspellings

- Anaphoides* Enock, 1915: 181. Misspelling of *Anaphoidea*; not a nomen nudum, as stated in Annecke and Douth (1961) and Huber (1992).
- Callitriche* Westwood, 1839: 78. Masculine, kallos (κάλλος) = beauty + thrix (θρίξ) [genitive: trichos (τριχός)] = hair. Unjustified emendation of *Eutriche* Nees [and junior homonym of *Callitriche* Poli (1791) – Mollusca].
- Cosmocoma* Förster, 1856: 117, 120. Feminine, kosmos (κόσμος) [χόσμος in Förster (1856)] Ornament, decoration + kome (κόμη) [χόμη in Förster (1856)] = hair. Perhaps referring to the pattern of setae on the head. Unnecessary replacement name for *Polynema* Haliday, 1833, not *Polynemus* Gronov (a fish) (Linné, 1758).
- Doryclytus* Dalla Torre, 1898: 428. Unjustified emendation of *Dorichlytus*.
- Erythmelus* Enock, 1915: 181. Misspelling of *Erythmelus*.
- Eurythmelus* Ogloblin, 1934: 243. Misspelling of *Erythmelus*.
- Granguriella* Soyka, 1956: 17. Misspelling of *Grangeriella*.
- Ideocentrus* Girault, 1930: 4. Misspelling of *Idiocentrus*.
- Limacis* Förster, 1856: 116, 117. Unjustified emendation of *Leimacis*.
- Lithisca* Ogloblin, 1955a: 498. Lapsus for *Neolitiscus*.
- Lytus* Blanchard, 1840: 293. Lapsus for *Litus*.
- Midliella* Soyka, 1956: 8. Lapsus for *Maidliella*.
- Narayana* Subba Rao, 1976: 87. Junior homonym of *Narayana* Distant (Hemiptera: Issidae).
- Neolitiscus* Ghesquière, 1946: 371. Masculine, *Neolitus* + iskos (ισκος) = little (masculine diminutive). Unnecessary replacement name for *Neolitus* Ogloblin, 1935, not *Neolithus* Scott, 1882 (Hemiptera).
- Neurotes* Enock, 1915: 178. Junior objective synonym and homonym of *Neurotes* Enock, 1914.
- Oglobliniella* Soyka, 1946: 180. Feminine, proper name + -ella = little. Named after the Argentinian (originally Russian) taxonomist Alejandro Ogloblin (1891–1967), who studied Hymenoptera in the José C. Paz Laboratory, Buenos Aires. Junior objective synonym, rejected in favour of *Mymar* (China 1965).
- Packardiella* Ashmead, 1904: 364. Feminine, proper name + -ella = little. Named after the American entomologist A.S. Packard (1839–1907) who worked at Brown University, Providence, Rhode Island. Unnecessary replacement name for *Pteratomus* Packard. Syn. with *Anagrus* by Annecke & Douth (1961).
- Pteroclisia* Förster, 1856: 144. Feminine, pteron (πτερόν) [πτερος in Förster (1856)] = wing + klisis (κλίσσις) [χλίσσις in Förster (1856)] = bend, curve. Referring to the curved forewing. Unnecessary replacement name for *Camptoptera* Förster not *Camptopteris* (a fossil plant).
- Rhachistus* Dalla Torre, 1898: 429. Unjustified emendation of *Rachistus*.
- Scolopsomymar* Ogloblin, 1957: 414. Lapsus for *Scolopsopteron*.
- Walkerella* Dalla Torre, 1898: 425. Unjustified emendation of *Valkerella* (*Walkerella* is a genus of Agaonidae).

Names excluded here from Mymaridae

I exclude three genera currently classified in Mymaridae (Noyes 2002), for the reasons provided.

Allomymar Kieffer, 1913b: 30. This taxon was described as having the mandibles absent, replaced by hairy lobes, the antennae 7-segmented, tarsi 5-segmented, and wing venation more than half wing length. The only mymarid I know that has the correct combination of mandibular and antennal features would be a species of *Erythmelus* (*Paralleleptera*). But all members of *Erythmelus* have 4-segmented tarsi and the wing venation is much shorter than half the wing length. Therefore *Allomymar* cannot be the same as *Erythmelus*. When I sent the original description to M. Hayat (Aligarh, India) in 1998 for his opinion he suggested that *Allomymar* might be a male specimen of *Encarsia* Förster, 1878 (Aphelinidae). Until the type of *Allomymar taitae* Kieffer, 1913, is found the correct family placement of *Allomymar* cannot be ascertained.

Metanthemus Girault, 1928: 4. Girault described the only included species as having 5-segmented antenna with a 2 segmented funicle, and placed it in Mymaridae (Anagrini). Based on these features it cannot belong to the Mymaridae but rather to the Aphelinidae.

Shillingsworthia Girault, 1920b: 2. This is a hypothetical concept (a species from Jupiter) described by Girault to disparage, tongue-in-cheek, his boss, Dr Illingworth. It is excluded from zoological nomenclature [ICZN (1999), article 1.3.1).

Names of Mymarommatidae

Archaeromma Yoshimoto, 1975: 503. Neuter, archaios (ἀρχαῖος) = from the beginning, old + omma (ὄμμα) = eye. Referring to the age of this extinct genus.

Galloromma Schlüter, 1978: 74. Neuter, proper name + omma (ὄμμα) = eye. Named after Gaul (Latin for France) where the fossil was collected. Probably a syn. of *Archaeromma* (Carpenter 1992).

Palaeomymar Meunier, 1901: 289. Neuter, palaeos (παλαιός) = ancient + *Mymar*. Referring to the age of the genus.

Mymaromma Girault, 1920a: 38. Neuter, *Mymar* + omma (ὄμμα) = eye. A much more likely ending would be -oma (ὄμα) = signifying condition or having the nature of, i.e. similar to *Mymar*, which means that Girault spelled the scientific name incorrectly. Referring to the similarity with *Mymar*. Syn. with *Palaeomymar* by Douth (1973).

Petiolaria Blood et Kryger, 1922: 229. Feminine, petiolus = stalk + -ia = pertaining to. Presumably referring to the 2-segmented gastral petiole. Syn. with *Mymaromma* by Girault (1930) and with *Palaeomymar* by Douth (1973).

Mymaromella Girault, 1931: 4. Feminine, *Mymaromma* + -ella = little. A small *Mymaromma*. Syn. with *Palaeomymar* by Douth (1973).

Family-group names of Mymaridae and Mymarommatidae

The first author to use a name explicitly with a different rank is given in brackets. Article 36.1 of the ICZN (1999) nevertheless applies.

Alaptidae Perkins (1912); **Alaptinae** [Perkins (1912)]; **Alaptini** [Girault (1929a)]; **Alaptoidea** [Soyka (1949)].

Anagrinae Perkins (1912); **Anagrini** [Girault (1929a)].

Anaphini Ashmead (1904); **Anaphina** [Schmiedeknecht (1909)].

Aresconini Viggiani (1988).

Bruchomymarini Ogloblin (1952).

Camptopterinae Viggiani (1988).

Cremnomymarini Ogloblin (1952).

Erythmelini Viggiani (1988).

Eubroncinae Yoshimoto et al. (1972).

Gonatocerinae Howard and Ashmead (1896); **Gonatocerini** Ashmead [(1904)]; **Gonatocerina** [Schmiedeknecht (1909)]; **Gonatoceridae** [Mani & Saraswat (1973)].

Lymaenonidae Ghesquière (1942); **Lymaenonini** [Ghesquière (1942)]; **Lymaenoninae** [Viggiani (1988)].

Mymaridae [as Mymares] Haliday (1833); **Mymaridae** [Haliday (1839) — first explicit use at family rank];

Mymaroidae [Förster (1856)]; **Mymarinae** [Howard & Ashmead (1896)]; **Mymarini** [Ashmead (1904)];

Mymarina [Schmiedeknecht (1909)]; **Mymaroidea** [Ghesquière (1942)].

Mymarommatidae Debauche (1948); **Mymarommatidae** [Brues et al. (1954)].

Ooctionini Ashmead (1904); **Ooctionina** [Schmiedeknecht (1909)]; **Ooctioninae** [Perkins (1912)].
Polynematini Ogloblin (1942).
Ptilomymarini Viggiani (1988).
Stephanodini Ogloblin (1942).
Stethynini Viggiani (1988).
Triadomerinae Yoshimoto (1973).

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Boucekelimini trib. nov., with genera *Boucekelimus* gen. nov. and *Tatiana* gen. nov. (Hymenoptera: Eulophidae) from Western Australia

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Abstract. A new tribe, Boucekelimini trib. nov., and two new genera, *Boucekelimus* gen. nov. and *Tatiana* gen. nov., are described from Western Australia: Both genera display morphological adaptations associated with extremely long ovipositors which are housed internally rather than being exerted.

Taxonomy, descriptions, new tribus, new genus, new species, Hymenoptera, Chalcidoidea, Eulophidae, Australia

INTRODUCTION

The single most important contribution to the study of Australian Eulophidae was made by Zdeněk Bouček in his classic study on the Chalcidoidea of Australasia (Bouček 1988). This work culminated a research career spanning several decades, and brought a sense of order to the descriptive work of A. A. Girault (for more insight into Girault, see Dahms 1978). In the present paper, two new genera of Australian Eulophidae, *Boucekelimus* gen. nov. and *Tatiana* gen. nov., are described to commemorate Dr. Bouček and his wife, Tania, who supported him through his years of research.

The new genera, *Boucekelimus* gen. nov. and *Tatiana* gen. nov., are placed in the tribe Boucekelimini, trib. nov., which is left as unplaced but is considered to be near other unplaced tribes such as Ophelimini, Anselmellini and Platytetracampini (Gauthier et al. 2000). Further studies will be necessary to clarify the relationships of the new genera. *Boucekelimus* gen. nov. was reared from galls on *Melaleuca* (Myrtaceae), but host relationships for *Tatiana* gen. nov. are unknown. Both genera show unusual morphological adaptations associated with extremely long ovipositors which are stored internally.

MATERIALS AND METHODS

Format. A single diagnosis and description for each new genus and species combination. This is done to avoid repetition because until other species are known it is not clear what are generic level or species level characters.

Terminology used in this paper is taken from Gibson (1997) and Graham (1987); OOL, ocell–ocular distance; POL, post-ocular distance; MPS, multiporous plate sensilla; SMV, submarginal vein; MV, marginal vein.

Acronyms used in the text are as follows. ANIC – Australian National Insect Collection, CSIRO Entomology, Canberra, Australia; BMNH – The Natural History Museum, London, United Kingdom; CNC – Canadian National Insect Collection, Ottawa, Ontario, Canada; PPRI – Biosystematics Division, Plant Protection Research Institute, Pretoria, South Africa; QMB – Queensland Museum, Brisbane, Australia; SAMA – South Australian Museum, Adelaide, SA, Australia; USNM – United States National Museum of Natural History, Washington, D.C., USA; WAM – Western Australian Museum, Perth, WA, Australia.

TAXONOMY

Boucekelimini trib. nov.

TYPE GENUS. *Boucekelimus* gen. nov.

DIAGNOSIS. Antenna placed very low on face, near clypeal margin; with long club, and 4 or 5 small segments between pedicel and club (the segments sometimes difficult to differentiate between anelli and funicular segments). Submarginal vein with a single dorsal seta; postmarginal vein about the same length as stigmal vein. Gaster elongate, ovipositor not exerted, but apparently quite long and either coiled within the gaster (*Boucekelimus* gen. nov.) or with gaster modified to contain ovipositor which extends anteriorly under mesosoma to level of head (*Tatiana* gen. nov.); base of gaster with membranous area. Axillae moderately (*Tatiana* gen. nov.) to strongly (*Boucekelimus* gen. nov.) advanced. Scutellum without submedian or sublateral lines. Propodeum smooth, without median carina or plicae.

DISCUSSION. The new tribe described here is distinguished by the characters given in the diagnosis. It does not readily fit into any of the defined subfamilies or tribes of Eulophidae. The main characters that differentiate it are:

- antennae situated quite low on the face; this character is not common in the Eulophidae, and is restricted to a few unrelated genera, such as *Trichospilus* Ferrière, 1930 (Eulophini) and *Pronotalia* Gradwell, 1957 (Tetrastichinae);
- forewing with a single setae on the submarginal vein; this character is found only in several genera of Tetrastichinae (e.g., *Tetrastichus* Haliday, 1844; *Quadrastichus* Girault, 1913), a few genera of Euderomphalini (e.g., *Pomphale* Husain, Rauf et Kudeshia, 1983; *Baeoentedon* Girault, 1915), and some aberrant Entedonini (e.g., *Myrmokata* Bouček, 1972; *Encyrtomphale* Girault, 1915);
- gaster displaying modifications to accommodate a long internal ovipositor, similar modifications are not seen in other eulophids.

Additionally, Boucekelimini trib. nov. lacks the defining characteristics of the major groups of Eulophidae as follows:

- Eulophini has the propleura meeting posteriorly and concealing the prosternum (divergent posteriorly to reveal the prosternum in Boucekelimini trib. nov.).
- Cirrospilini has a transverse sulcus on the face between the frontofacial sutures and the toruli, and a clearly defined 2 or 3 segmented.
- Tetrastichinae generally lacks a postmarginal vein, and has paired submedian and sublateral lines on the scutellum.
- Entedoninae has a single pair of setae on the scutellum, two dorsal setae on the submarginal vein, and the frontofacial suture well separated from the anterior ocellus.
- Euderomphalini has the pronotum and dorsellum hidden in dorsal view by the mesoscutum and scutellum respectively, the antenna with only 1 or 2 funicular segments, and the clypeus delimited dorsally by a distinct and curved sulcus.
- Anselmellini has a swollen marginal vein, deep and straight notauli, no frontofacial sutures, the antenna inserted high on the head, and a long radicle.
- Ophelimini has a swollen marginal vein, deep and straight notauli, and no frontofacial sutures.
- Platytetracampini is not very clearly defined by synapomorphies, but differs from Boucekelimini trib. nov. in having more than three setae on the submarginal vein, and a short, ovate gaster.
- Euderinae has eight gastral segments rather than the normal seven for Eulophidae, and 4 or 5 clearly defined funicle segments.

***Boucekelimus* gen. nov.**

TYPE SPECIES. *Boucekelimus elongatus* sp. nov..

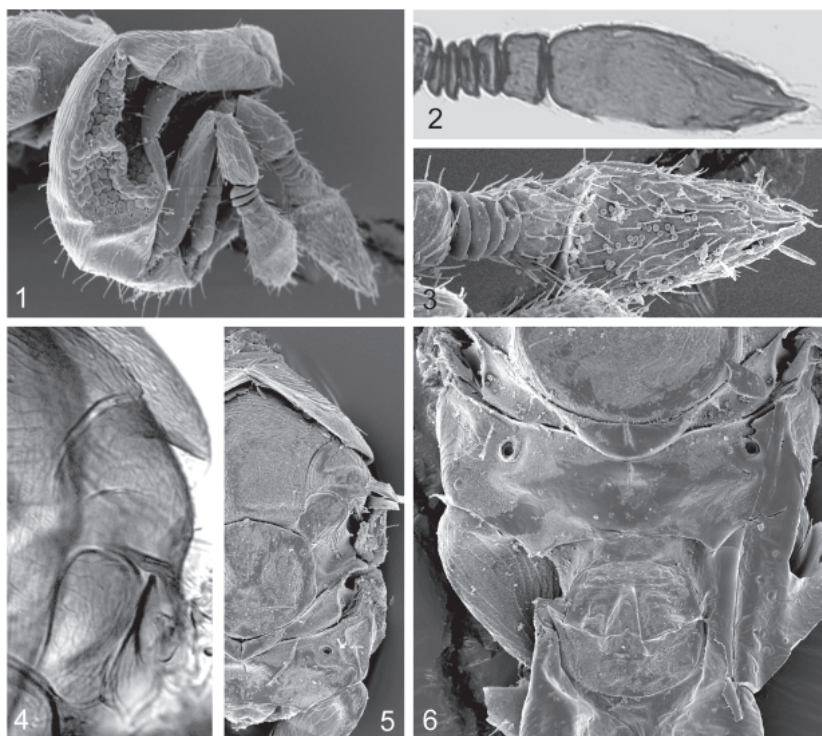
ETYMOLOGY. *Boucekelimus* is a combination of Bouček, who we are honoring with this generic description, and *Ophelimus* Haliday, 1844, which is another Australian gall forming eulophid that may be related to this genus. Gender masculine.

***Boucekelimus elongatus* sp. nov.**

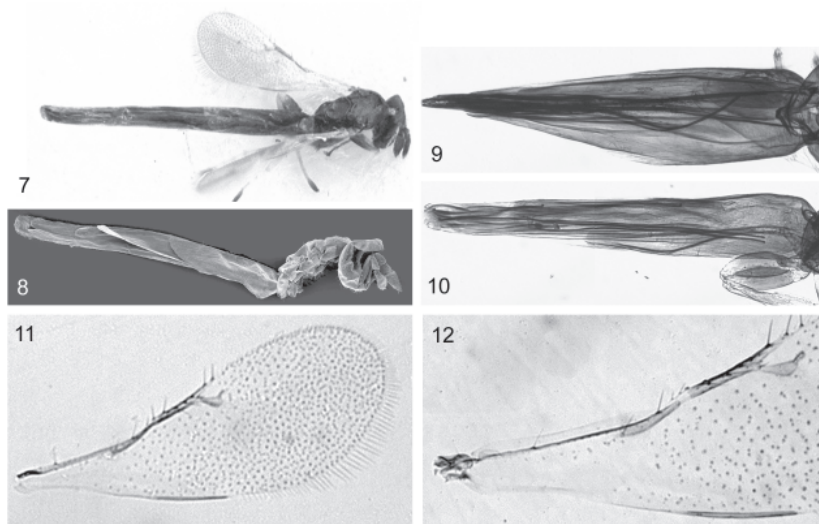
(Figs 1–12)

TYPE MATERIAL. Holotype, female, labelled: Near Swan Lagoon, near Grass patch, Western Australia, Australia, 33°14.18'S 121°38.97'E, 07.xi.2000, KAD 2000, WA site 76, KA Davies, reared from 'Moss' galls on *Melaleuca* sp. (ANIC). Paratypes: 46♀, 12♂ same data as holotype (22♀, 9♂ ANIC; 4♀, 1♂ each: BMNH, CNC, USNM; 3♀ each: PPRI, QMB, SAMA, WAM).

DIAGNOSIS. Mesosoma flat; notaulus incomplete, present only anteriorly. Gaster lanceolate, 1.8–2.8 times as long as head plus mesosoma. Antenna with 5 segments between pedicel and clava, the segments not clearly differentiated into anelli and funicular segments. Axilla strongly advanced, placed almost entirely anterior to scuto-scutellar suture. Malar sulcus present.



Figs 1–6. *Boucekelimus elongatus* sp. nov. 1 – head and antennae, antero-lateral view; 2, 3 – clava and antennal segments, ♀; 4 – notaulus and axilla, dorsal view; 5 – mesosoma, dorsal view; 6 – propodeum and basal area of gaster.



Figs 7–12. *Boucekelimus elongatus* sp. nov. 7 – habitus, ♀; 8 – body, lateral view, ♀; 9 – gaster and ovipositor, dorsal view; 10 – gaster and ovipositor, lateral view; 11 – forewing; 12 – base of forewing and venation.

DESCRIPTION. Female [described from shrunken specimens] Length 1.15–1.45 mm. Head and mesosoma mainly dark green metallic with brownish tint. Dorsellum brownish-yellow. Gaster brown.

Head (Fig. 1). Malar space short, with straight and weak malar sulcus. Torulus low on head very close to clypeal margin, separated from clypeal margin by about 2/3 length of its own diameter. Scrobal depression appearing membranous, at least dorsally. Frontofacial suture present as a transverse suture just ventral to anterior ocellus. POL approximately 2.5–3.0 times as long as OOL. Occipital foramen high on back of head.

Antenna (Figs 2,3) with 5 segments between pedicel and clava that are not clearly differentiated into anelli and funicular segments, the 5th segment the longest and transverse rectangular and the other 4 segments anelliiform, and all the segments without multiporous plate sensillae (MPS). Club composed of a single segment (Figs 2–3) and with several MPS; about twice as long as combined length of segments between pedicel and clava. Pedicel approximately equal in length to following 5 segments. Scape not exceeding level of vertex.

Mesosoma (Figs 4, 5, 8) flattened. Pronotum extremely narrowed medially. Propleura diverging posteriorly and revealing prosternum. Mid lobe of mesoscutum with raised reticulation and with 2 setae on each side. Notaulus incomplete. Axilla well advanced and rounded anteriorly. Scutellum without submedian or sublateral lines, with 2 pairs of setae, and smoothly rounded posteriorly. Propodeum (Fig. 6) smooth and shiny, without median carina or plicae, and about twice as long as dorsellum. Propodeal spiracle separated from anterior margin of propodeum by its own diameter; entire rim exposed and in shallow depression. Callus with 2–3 setae.

Gaster (Figs 8–10) sessile, narrow, lanceolate and with membranous area at base (Fig. 6). Length of gaster variable, 1.8–2.8 times as long as head plus mesosoma (variation may be due in part to the shrunken condition of specimens). Ovipositor apparently quite long and coiled inside gaster (Figs 9–10), although not visible externally.

Forewing (Figs 11,12) 2.5–2.7 times as long as broad. Submarginal vein with 1 seta before middle and joining parastigma distally to proximal end of parastigma; marginal vein stout and with hyaline break at base; costal cell more than twice as long as marginal vein; postmarginal vein from as long as to slightly longer than stigmal vein; uncus well developed and about 0.3 length of stigmal vein. Costal cell : marginal vein : stigmal vein : postmarginal vein = 4.8–6.3 : 1.9–2.2 : 1.0 : 0.9–1.6. Pilosity beneath marginal vein, stigmal vein and postmarginal vein more or less sparsely distributed.

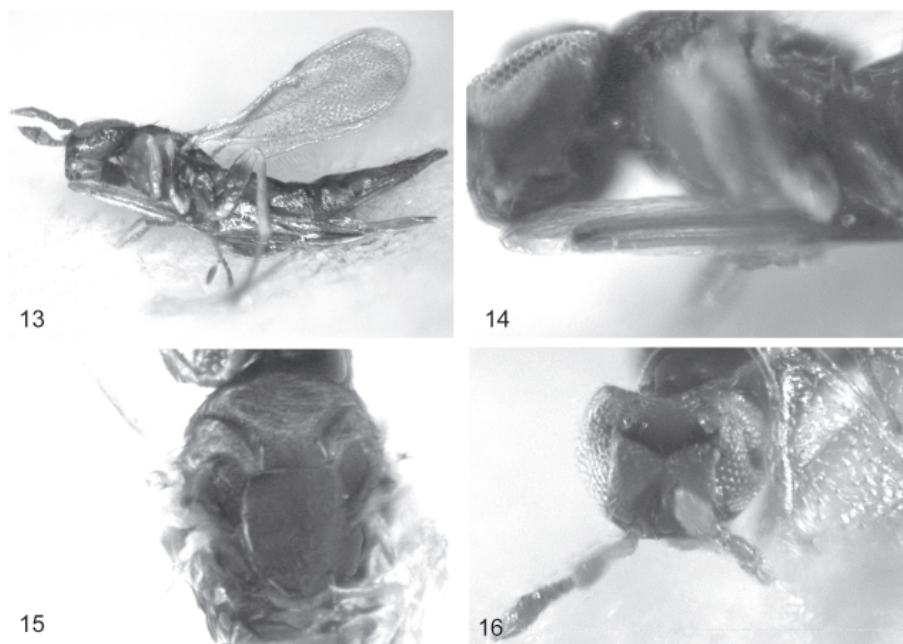
Male. Length 0.64 – 0.9 mm. Similar to female except: club with distinct sutures delimiting 3 claval segments; scape slightly ventrally expanded and flattened; gaster shorter than for female, almost as long as mesosoma or slightly shorter than head plus mesosoma.

COLLECTING CIRCUMSTANCES. Reared from “Moss” galls on *Melaleuca* sp. (Myrtaceae).

DISTRIBUTION. Western Australia.

ETYMOLOGY. The species name *elongatus* is used to describe the very long gaster of females of this insect.

DISCUSSION. This species is easily distinguished by the characters given in the diagnosis. *Boucekelimus* gen. nov. is distinguished from *Tatiana* gen. nov. by the provided diagnostic characters, including having the female gaster at least 1.8 times as long as the head plus mesosoma and lacking the sheath made from the basal sternite which projects anteriorly under the head in *Tatiana* gen. nov.



Figs 13–16. *Tatiana mymaroides* sp. nov. 13 – habitus, ♀; 14 – ventral sternite projecting forward and bearing ovipositor, ventro-lateral view; 15 – mesosoma, dorsal view; 16 – face and vertex, frontal view.

***Tatiana* gen. nov.**

TYPE SPECIES. *Tatiana mymaroides* sp. nov.

ETYMOLOGY. Named for Tatiana (Tania) Bouček, who has supported and stood by her husband throughout his career as an entomologist, and has tolerated his passion for small wasps. Gender feminine.

***Tatiana mymaroides* sp. nov.**

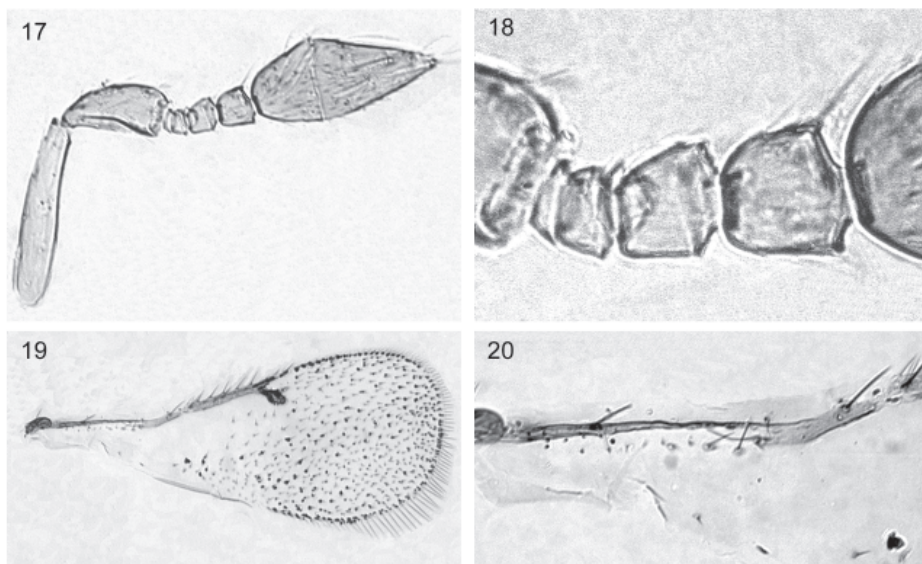
(Figs 13–20)

TYPE MATERIAL. Holotype, female, labelled: Australia, Western Australia, Stirling Range NP 600m ~ 2 km, SW, Camel Lake, 34°18.4'S 118°01.1'E, 13. xi. 2002, swp., G. Platner, PEET 02-0386 (ANIC). Paratypes: 2 ♀, same data as holotype (1♀ ANIC); same data as holotype except coll. J.D. Pinto, PEET 02-0385 (1♀ ANIC).

DIAGNOSIS. Basal gastral sternite protruding as sheath and projecting under mesosoma anteriorly to level of head, the sheath accommodating the ovipositor. Notaulus complete and weak. Axilla moderately advanced. Propodeum very short medially and hidden by dorsellum. Antenna with 1 anellus and 3 funicular segments. Malar sulcus absent.

DESCRIPTION. Female. Length 0.8 – 1.0 mm. Mesosoma mainly brown with green metallic tint. Head and gaster brown.

Head (Fig. 16) with gena swollen; malar space short, without malar sulcus. Torulus located very low on head, almost touching clypeal margin. Scrobal area rather deep. Frontofacial suture just ventral to anterior ocellus (appearing as a deep groove in shrunken specimen). POL more than 4 times as long as OOL.



Figs 17–20. *Tatiana mymaroides* sp. nov. 17 – antenna, ♀; 18 – funicular segments; 19 – forewing; 20 – submarginal vein.

Antenna (Figs 17,18) with 1 anellus and 3 funicular segments, F1 transverse, F2 and F3 quadrate, and each segment slightly longer and broader than previous one. Club swollen, about 2 times as broad as funicular segments; composed of 3 segments, with suture between second and third segment indistinct. Scape not reaching above vertex.

Mesosoma (Fig. 15) convex in lateral view. Pronotum very short dorsally. Propleura diverging posteriorly and revealing prosternum. Mid lobe of mesoscutum with 2 setae on each side. Notaulus complete and weak, posteriorly shallow. Axilla moderately advanced; scapula angulated posteriorly along the notaulus. Scutellum approximately as long as mid lobe of mesoscutum and with 2 pairs of setae; without submedian or sublateral lines. Propodeum very narrow medially, hidden by dorsellum, and smooth without any carina or plicae. Entire rim of propodeal spiracle exposed. Callus with 2–3 setae.

Gaster (Fig. 13,14) sessile, lanceolate and with membranous area at base. Length of gaster about 1.6 times as long as head plus mesosoma. Basal sternite membranous and projecting forward to level of head as sheath containing ovipositor, which is folded up inside and can be seen through the membrane. Apex of ovipositor sheath not exerted out of gaster.

Forewing (Figs 19,20) 2.3 – 2.5 times as long as broad. Submarginal vein with 1 seta before middle, joining parastigma distally to proximal end of parastigma; costal cell about 1.6–1.7 times as long as marginal vein; marginal vein slightly swollen basally and with hyaline break at base; postmarginal vein as long as or slightly shorter than stigmal vein. Costal cell : marginal vein : stigmal vein : postmarginal vein = 4.5 – 4.8 : 2.7 – 2.8 : 1.0 : 0.8 – 1.0. Speculum large, extending to stigmal vein.

Male. Unknown.

DISTRIBUTION. Western Australia.

ETYMOLOGY. The species name *mymaroides* is used in reference to the unusual shape of the basal sternite, which projects forward and encompasses the ovipositor.

DISCUSSION. The most significant feature of *Tatiana* gen. nov. is the basal sternite which projects anteriorly below the mesosoma as far as the mouth opening, and contains a coil of the ovipositor. This is the first record of such a structure in the Eulophidae. Within the Chalcidoidea, such a structure is only known in some genera of the Mymaridae (e.g., *Idiocentrus* Gahan, 1927; *Cybomy-mar* Noyes et Valentine, 1989; *Australomymar* Girault, 1929) (Noyes & Valentine 1989).

A c k n o w l e d g e m e n t s

We would like to thank Kerrie Davies (South Australian Museum), Andrew Austin and Nick Stevens (University of Adelaide) and John Pinto and Gary Platner (University of California Riverside) for making material available for this study.

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***Zebe cornutus* gen. et sp. nov., a new Pireninae (Hymenoptera: Pteromalidae) with 4-segmented tarsi and a mesoscutal horn**

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Abstract. *Zebe cornutus* gen. et sp. nov. is described from Brunei, and placed in the Pireninae (Pteromalidae). This genus is unusual for a pteromalid in having 4-segmented tarsi, and unique among the Chalcidoidea in having a horn projecting from the mesoscutum.

Taxonomy, descriptions, Hymenoptera, Chalcidoidea, Pteromalidae, Pireninae, Brunei, Oriental region

INTRODUCTION

The new genus and species described in this paper, *Zebe cornutus* gen. et sp. nov., has been a source of deliberation for many years. The specimen was collected in Brunei and has been in the possession of Zdeněk Bouček for two decades. During that time, many hymenopterists have had a chance to examine it and discuss its possible placement. The possession of certain characters, notably 4-segmented tarsi and a reduced number of antennal segments, have invariably led workers to the conclusion that it belonged to the Eulophidae.

After much consideration, I am describing the species in the Pteromalidae, subfamily Pireninae. It is unusual for Pteromalidae in that virtually all pteromalids have 5-segmented tarsi. However, reduction characters such as the loss of a tarsal segment are not uncommon in the Chalcidoidea, and the loss of a tarsal segment does not exclude a taxon from belonging to any given family (La Salle et al. 1997, Delvare & La Salle 2000). A more complete elaboration of the reasons for placing *Zebe* gen. nov. in the Pireninae is given in the discussion.

MATERIALS AND METHODS

Terminology used is taken from Gibson (1997). Further references to any taxa of Chalcidoidea mentioned in this paper can be found in Noyes (2002). The acronym BMNH stands for The Natural History Museum, London, United Kingdom. A single diagnosis and description are offered for the new genus and species. This is done to avoid repetition in the species and genus description; until other species are known it is not clear as to what are generic level or species level characters.

SYSTEMATICS

***Zebe* gen. nov.**

TYPE SPECIES. *Zebe cornutus* sp. nov., gender masculine.

INCLUDED SPECIES. The only known species is *Zebe cornutus* sp. nov.

ETYMOLOGY. The genus name is derived from the pronunciation of the initials Z. B., for Zdeněk Bouček, who has done more for the study of Chalcidoidea than any other single worker. His

dedication to the field, overall knowledge of Chalcidoidea, and synthesis of thought concerning chalcidoid classification have laid the foundation for studies for years to come. He has freely provided advice and ideas for a generation of chalcidologists, and, on a personal note, he has been a colleague, friend and mentor to me throughout my career. It gives me great pleasure to dedicate this bizarre and wonderful genus to Zdeněk Bouček. Gender masculine.

***Zebe cornutus* sp. nov.**
(Figs 1–9)

TYPE MATERIAL. Holotype, female, labelled: Brunei, Ulu, Tamburong Ridge, 14.ii–9.iii.1982, M. C. Day (BMNH).

DIAGNOSIS. Easily recognizable from all other Chalcidoidea by the presence of a horn projecting from the anterior of the mesoscutum and extending over and beyond the head (Figs 1–4). Other distinctive characters include: tarsi 4-segmented; clypeus protruding in a rounded lobe medially; corner of mouth margin somewhat angulate; antenna with two segments between the pedicel and club, comprising either a large anellus or a small first funicle segment, followed by a larger funicle segment.

DESCRIPTION OF HOLOTYPE. Female. Length 1.65 mm (to apex of horn 1.8 mm). Head and body dark brown; mesoscutal horn light brown, translucent; fore and middle coxae white, hind coxa dark brown. Fore femur yellow, darkened dorsally; middle and hind femora brown; tibiae and tarsi yellow. Antenna with scape yellow, remaining segments dark brown.

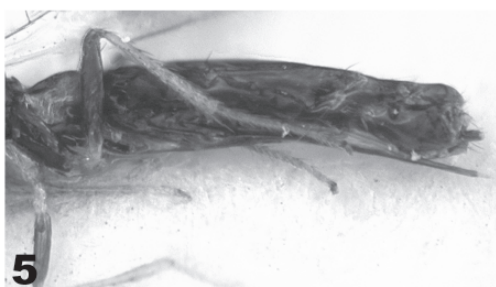
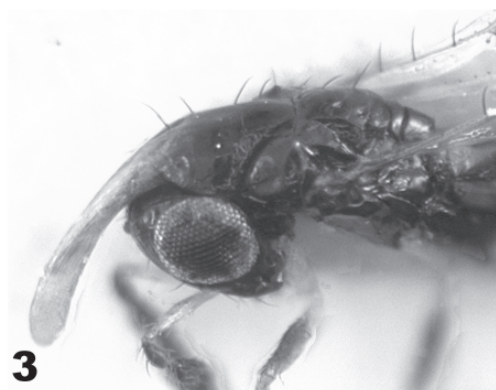
Head (Figs 1, 3, 6). Sculpture generally smooth and shiny. Lateral ocellus separated by less than its own length from eye margin. Scrobal depression broad and shallow. Torulus at or slightly below level of ventral eye margin. Clypeus protruding into a rounded lobe (Fig. 6); corners of mouth margin somewhat angulate (Fig. 6). Vertex and frons near eye margin with several strong, erect setae (Fig. 1).

Antenna (Fig. 7). Scape long and slender, about 6 times longer than wide. First flagellar segment about 1/6 the length of second, with long, strong setae; it is not clear whether this is an anellus or reduced first funicle segment. Club about equal in length to pedicel and first two flagellar segments.

Mesosoma (Figs 1–4). Mesosoma shiny, smooth or with lightly coriaceous (engraved) sculpture; with several strong, erect setae: 3 pairs on midlobe of mesoscutum, 3 on each scapula, 2 on each axilla, and 3 pairs on scutellum. Pronotum reduced and concealed by mesoscutum. Mesoscutum with a horn projecting from anterior end and extending over and beyond head (Figs 1–4). Mesoscutal horn translucent, and what appears to be a coil of the ovipositor is visible within it (although the apex of the ovipositor is visible at the apex of the gaster, Fig. 5). Notaulus complete; axilla only slightly advanced anterior to scuto-scutellar suture; scapula wide. Propodeum smooth, without distinct carinae; propodeal spiracle small, placed within its own diameter of anterior margin of propodeum. All coxae and legs slightly long and narrow. Tarsi 4-segmented; fore tibial spur strong, curved, apically bifid.

Forewing (Fig. 9). Entire wing slightly infumated, more strongly so medially. Submarginal vein with 4 strong setae. Base of parastigma truncate. Basal line of hairs absent. Speculum large, extending to stigmal vein, not closed behind. Stigmal vein short, rounded into large stigma. Postmarginal vein longer than stigmal vein.

Metasoma (Figs 2, 5). Metasoma long and narrow, almost 1.9 times longer than head plus mesosoma. Membranous areas present between first segment (petiole) and remainder of metasoma (gaster). Ovipositor sheaths very slightly protruding past apex of gaster; hypopygium long and narrow, extending to apex of ovipositor sheaths.



Figs 1–5. *Zebe cornutus* sp. nov., female holotype. 1 – electron micrograph of head and mesosoma; 2 – habitus, lateral view; 3 – head and mesosoma, lateral view; 4 – head and mesosoma, dorsal view; 5 – gaster, lateral view.

Male. Unknown

BIOLOGY. Unknown.

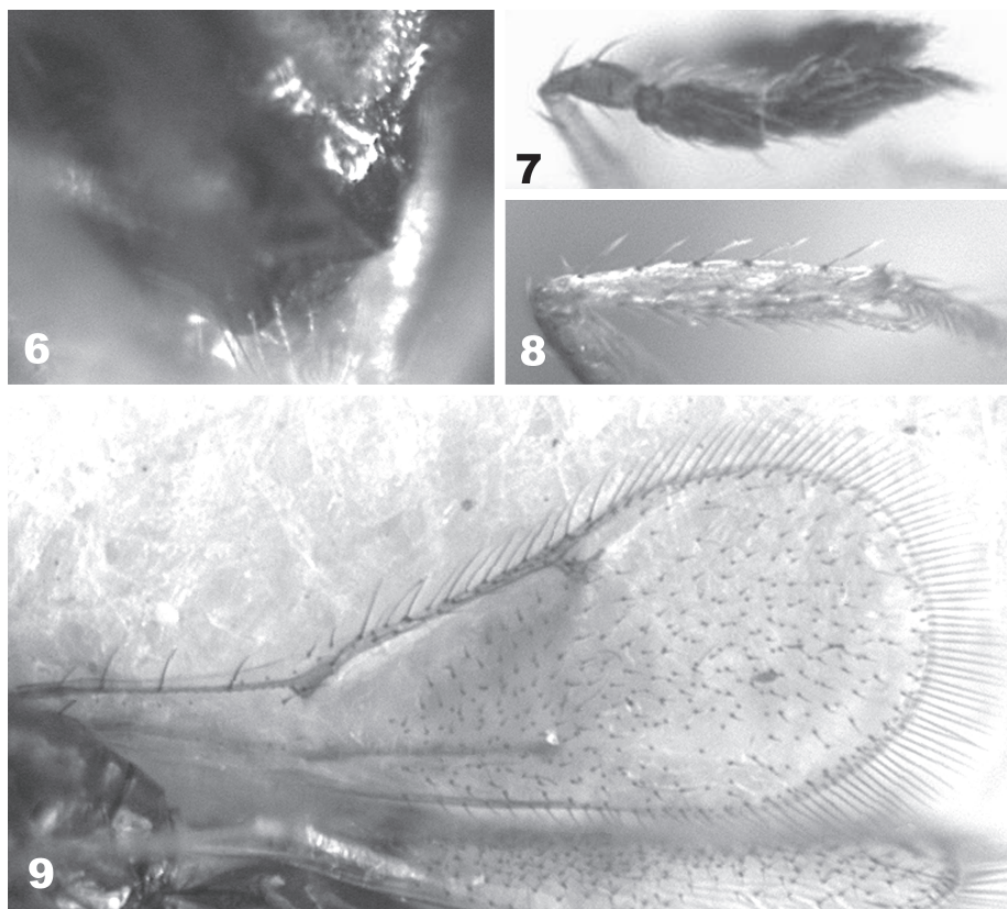
DISTRIBUTION. Brunei.

ETYMOLOGY. The name *cornutus* is Latin for horned, or bearing horns, and refers to the distinctive horn projecting from the mesoscutum.

DISCUSSION

As stated previously, the decision as to where to classify this unusual taxon was not straightforward. The decision to classify *Zebe* gen. nov. in Pteromalide and the Pireninae was made for the following reasons.

The combination of 4-segmented tarsi and a reduced number of antennal segments would suggest placement in the Eulophidae. However, *Zebe* gen. nov. has a strong, curved, apically bifid fore tibial spur (Fig. 8). Although it has been shown that there is variation in this character in



Figs 6–9. *Zebe cornutus* sp. nov., female holotype. 6 – clypeus and mouth margin; 7 – antenna; 8 – fore tibia; 9 – forewing.

Eulophidae (La Salle et al. 1997), this type of tibial spur is generally not found in the family. Similarly, it has been seen that reduction characters in number of antennal or tarsal segments have occurred repeatedly within the Chalcidoidea and may not be the best indicators of relationship (La Salle et al. 1997, Delvare & La Salle 2000). Finally, *Zebe* gen. nov. does not fit into any existing higher taxon of Eulophidae as recently defined (Gauthier et al. 2000).

If *Zebe cornutus* sp. nov. did have 5 tarsal segments, it would key quite easily to Pireninae using Bouček (1988), and it has many characters which resemble those seen in other members of this subfamily. For example, the antenna (Fig. 7) is similar to that of *Petipirene eximia* Bouček, 1988 (Bouček 1988: fig. 893), with either a large anellus or a small first funicle segment, a larger funicle segment, and a club. The forewing (Fig. 9) is also similar to *P. eximia* because the parastigma is truncate at its junction with the submarginal vein (seen in many pirenines), whereas in Eulophidae the base of the parastigma generally tapers into a point. The protruding clypeal margin and somewhat angulate lateral mouth margin (Fig. 6) are also frequently seen in pirenines, such as *Sirovena stigma* Bouček, 1988 (Bouček 1988: fig. 886) and *Macroglenes ?clypeatus* Girault, 1925 (Bouček 1988: fig. 892). Other characters which are consistent with Pireninae are: deep notauli, straight scuto-scutellar suture; the scapula and axilla large, and somewhat raised where they join; reduced number of antennal segments; presence of strong erect setae on the head and mesosoma.

To summarize, *Zebe* gen. nov. is best classified in Pteromalidae, subfamily Pireninae, based on the following three reasons: (1) reduction characters happen frequently in the Chalcidoidea and there is already evidence of reduction in the Pireninae in the number of antennal segments; (2) there is little evidence beyond the presence of four tarsal segments to support the placement of *Zebe* gen. nov. in the Eulophidae; and (3) *Zebe* gen. nov. agrees with Pireninae in all characters except the number of tarsal segments. If this classification is correct then the reduced number of tarsal segments is yet one more example of reduction in the Chalcidoidea.

Acknowledgements

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***Boucekiola malabarica* gen. nov. et sp. nov. (Hymenoptera:
Chalcidoidea: Eulophidae) from India**

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Abstract. The new genus and species *Boucekiola malabarica* gen. nov. et sp. nov. is described and illustrated. This new taxon is distinct from other Eulophidae based on the following combination of features: vertex raised; antennal formula 11443; pronotum with 2 unusually long setae; mesoscutum smooth and polished except for a few scattered pits; scutellum with two weak submedian grooves, each ending posteriorly in a setal pit; forewing with cubital line of setae continuous to base; and propodeum with median raised carina and an adjacent attached groove on either side of carina.

Taxonomy, description, new genus, new species, Hymenoptera, Chalcidoidea, Eulophidae, Oriental region

INTRODUCTION

The Indian subcontinent has a richly diverse fauna of Chalcidoidea, yet relatively very little is known about it. In particular, very little is known of the taxonomy of Indian Eulophidae. So far only 66 genera are recorded from the subcontinent compared with about 300 world genera (Noyes 2004). In my studies on the taxonomy of Eulophidae of Kerala I came across an interesting taxon that differs from all other described genera. This new taxon is described below.

Type material is deposited in the Department of Zoology, University of Calicut, Kerala, India (DZUC).

TAXONOMY

***Boucekiola* gen. nov.**

TYPE SPECIES. *Boucekiola malabarica* sp. nov.

DESCRIPTION. Head. hardly stout; vertex raised relative to dorsal margin of eye (Fig. 2); eye pilose; occiput in dorsal view (Fig. 1) moderately, triangularly concave, without carina; scrobes (Fig. 2) forming inverted V-shape, moderately deep depression not reaching anterior ocellus, the scrobal margins ecarinate; frons and vertex distinctly reticulate; gena short and narrow; malar sulcus deep and complete; mouth broad; mandibles tridentate. Antennae inserted at level of lower ocular line, short, with formula 11443 (Figs 3, 4).

Mesosoma (Fig. 1). Pronotum without distinct cross carina, with a paramedial pair of unusually long, posteriorly directed setae and several scattered shorter setae; mesoscutum polished, shiny, but with a few scattered pits. Notauli absent; axillae strongly advanced anteriorly, smooth and polished; scutellum with a pair of weak submedian lines, each ending posteriorly in a setal pit, and with 2 pairs of setae slightly beyond middle of scutellum; propodeum with distinct raised median carina and

closely attached groove on either side; plicae distinct and complete, submedian areas large, smooth and shiny. Legs slender, hind coxa bare; spurs short. Forewing (Fig. 1) with basal cell delimited apically by basal setal line and posteriorly by cubital setal line, the cubital setal line starting from base of forewing and closing speculum posteriorly; speculum extending anteriorly behind marginal vein to stigmal vein; submarginal vein with 4 dorsal setae; postmarginal vein longer than stigmal vein; costal cell very narrow; disc ventrally with a line of setae behind marginal vein.

Gaster (Fig. 1). petiolate, with petiole narrower basally and with broader apical area having tooth on either side; gaster subequal in length to mesosoma; T_1 longest, with a shallow basal fovea.

ETYMOLOGY. Named in honour of Zdeněk Bouček for his years of significant contributions to the taxonomy of world Chalcidoidea. Feminine in gender.

DISCUSSION. The genus *Boucekiola* gen.nov. belongs to the subfamily Eulophinae. It does not fit any genus included in the key to genera of Indian Eulophidae by Hayat (1985) or the description of any genera described by Narendran & Thomas (2003), Husain & Kudeshia (1983), Khan (1993), Jaikishan Singh & Khan (1997), or of any other genera from other regions of the world described by other authors. It keys to *Necremnoides* Girault (1913) in Bouček (1988), but differs from it and all other genera of Eulophidae by the following combination of characters: vertex raised; eyes pilose; antennal formula 11443; pronotum with a pair of unusually long setae; mesoscutum shiny, smooth with a few scattered pits; axillae strongly advanced; scutoscuteellar sulcus slightly convex anteriorly; scutellum with a pair of submedian weak carinae, the distance between the carinae much greater than distance between carina and lateral margin; scutellum with 2 pairs of setae; propodeum with a raised median carina and closely attached groove on either side of carina; forewing with cubital line of setae continuous to base of wing; postmarginal vein longer than stigmal vein; gaster petiolate, the petiole with a tooth on either side.

***Boucekiola malabarica* sp. nov.**

(Figs 1–4)

TYPE MATERIAL. Holotype: female, INDIA, Kerala, Calicut District, Nanminda, 16.xi.2003 (DZUC). Paratypes labelled: males with same data as holotype, 2 female, INDIA, Kerala, Calicut, Thiruvannur, 28.XI.1994; 1 female, Nilambur, 30.I.2003; 1 male, Kollam, Kolathurpuzha, 9.XII.2004 (DZUC). (All specimens collected by T.C.Narendran & Party).

DESCRIPTION. Female. Body length 1.08–1.1 mm. Black except for following: antenna with scape pale yellowish brown, pedicel brown, and flagellum dark brown; eye yellowish grey; ocelli pale, reflecting yellow; legs including coxae yellow; wings hyaline, pilosity and veins pale yellowish brown.

Head. Width in anterior view about 1.19x head length from dorsal margin to mouth margin; clypeus not demarcated clearly, lower margin entire; POL subequal to OOL. Relative length:width of scape = 26:8; pedicel = 16:8; $F1 = 9:9$; $F2 = 14:11$; $F3 = 12:12$; $F4 = 12:12$; clava = 28:12 (Fig. 3).

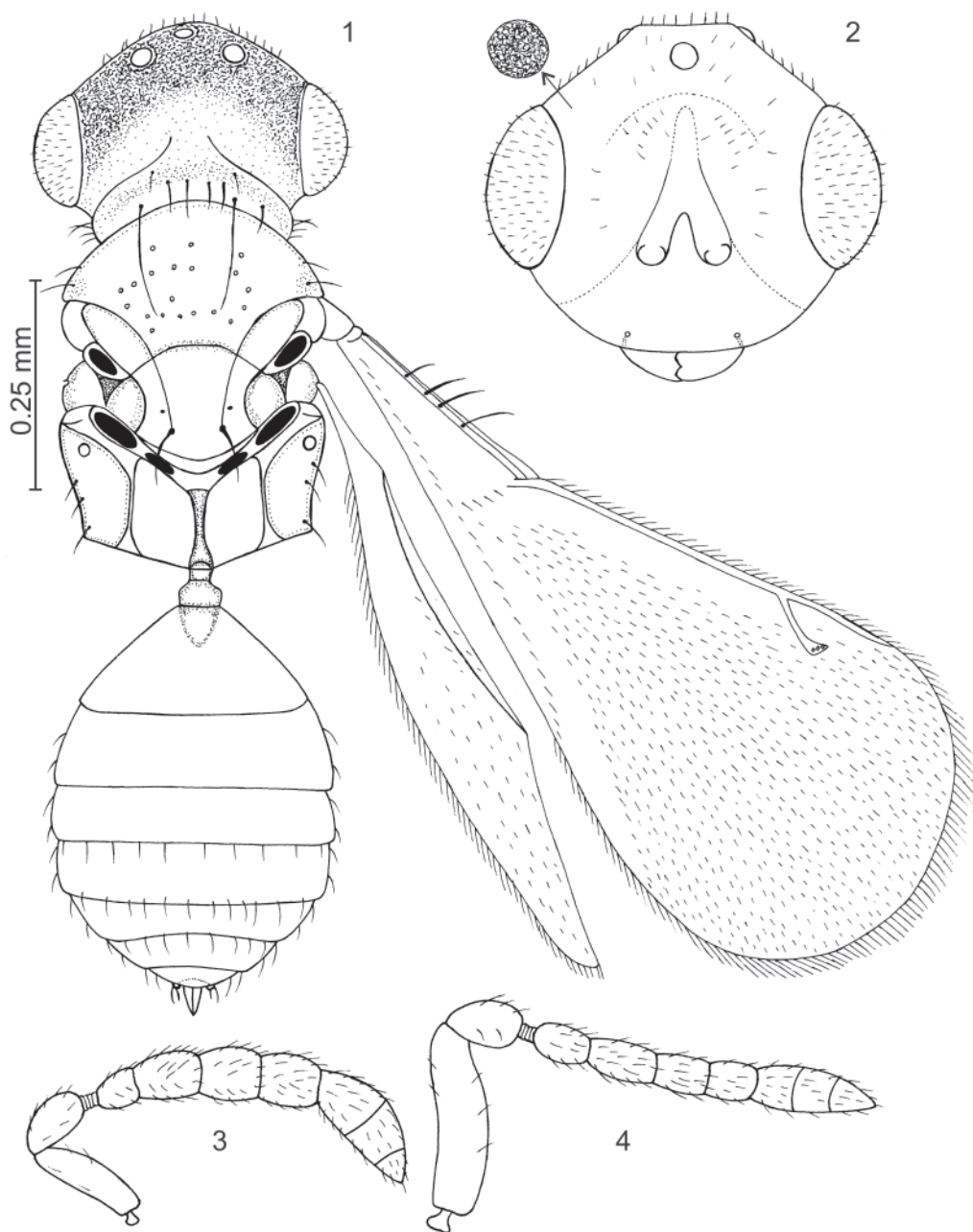
Mesosoma. Mesonotum with scutoscuteellar sulcus slightly convex anteriorly; mesoscutal lateral lobe with a black, deep fovea lateral to axilla; scutellum shorter than mesoscutum and with apex posteriorly arched. Metanotum with two deep transverse black foveae laterally. Propodeum with spiracle round and separated from posterior margin of metanotum. Forewing 2.26x as long as its maximum width; relative length of costal cell and veins: costal cell = 49, MV = 57, PMV = 25, STV = 14.

Metasoma. Petiole rugoso-reticulate. Gaster (excluding petiole) about 1.46x as long as maximum width; tergites as in Fig. 1.

Male. Length: 1.08 mm. Similar to female except for pale yellow patch on basal half of gaster dorsally. Antenna (Fig. 4) with flagellum narrower and scape broader than for female.

HOST. Unknown.

ETYMOLOGY. The species name is based on Malabar, which is the northern part of Kerala state where the species was collected.



Figs 1–4. *Boucekiola malabarica* gen. et sp. nov. 1 – female body, dorsal view; 2 – female head, anterior view; 3 – female antenna; 4 – male antenna.

A c k n o w l e d g e m e n t s

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***Psyllaephagus zdeneki* sp. nov. (Hymenoptera: Encyrtidae) from Iran,
a parasitoid of *Euphyllura pakistanica* (Hemiptera: Psyllidae)**

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Abstract. *Psyllaephagus zdeneki* sp. nov., a parasitoid of the olive pest *Euphyllura pakistanica* Loginova, 1973 in Iran, is described and characters are given to differentiate it from other similar species.

Taxonomy, new species, Hymenoptera, Encyrtidae, parasitoid, Hemiptera, Psyllidae, olive pest, Palearctic region

INTRODUCTION

Euphyllura pakistanica Loginova, 1973 (Hemiptera: Psyllidae) is the most important pest of olives in Iran. This olive psyllid produces two generations a year and overwinters as an adult on shoots and suckers. The overwintered adults mate from the middle of March and lay eggs on the terminal buds of olive in April. Each female deposits as many as 34 eggs. The eggs hatch in 8–10 days. There are five nymphal instars during a 28–30 day development period. Adults of this generation appear in late May and mate in early September. The second generation takes 45–47 days and adults appear in late October. During a survey for natural enemies of the psyllid conducted between 1998 and 2000 in Shiraz (Fars Province), 11 species of predators and two species of parasitoids were collected, the most important of these being a previously unknown species of parasitoid belonging to *Psyllaephagus* Ashmead, 1900 (Hymenoptera: Encyrtidae), a genus that includes exclusively parasitoids of jumping plant-lice (Psylloidea). In order to facilitate further studies on this parasitoid it is described below. This new species is named in honour of Zdeněk Bouček in celebration of his 80th birthday.

ABBREVIATIONS

DEPOSITORIES. BMNH –Natural History Museum, London, United Kingdom.

MORPHOLOGY. AL – aedeagus length, EL – maximum eye length, EW – maximum eye width, FV – minimum frontovertex width, FWL – fore wing length, FWW – fore wing width, GL – gonostylus (=3rd valvula) length, HW – maximum head width, HWL – hind wing length, HWW – hind wing width, MS – malar space, MT – mid tibia length, OCL – occipital-ocellar line, OL – ovipositor length, OOL –ocular-ocellar line, POL – posterior-ocellar line, SL – scape length, SW – maximum scape width.

TAXONOMY

Psyllaephagus Ashmead, 1900

Psyllaephagus Ashmead, 1900: 382.

TYPE SPECIES. *Encyrtus pachypsyllae* Howard, 1885.

DIAGNOSIS. About 1–2 mm long; males and females essentially similar in appearance except for antennae and genitalia; head and thorax in most species metallic green; occipital margin rounded; mandibles generally with one tooth and a broad, straight truncation; marginal vein punctiform, or hardly longer than broad (some Australian species with marginal vein 3–4× as long as broad); postmarginal vein always well developed, at least about half as long as stigmal vein; mesoscutum without a conspicuous pit or depression laterally; axillae meeting medially; mesopleuron not extending past posterior margin of propodeum so that propodeum is clearly visible in lateral view above hind coxae. Female: funicle 6-segmented and cylindrical in cross section, covered with setae that are shorter than diameter of segments; clava 2- or 3-segmented; hypopygium not extending to apex of gaster. Male: funicle 6-segmented, the segments varying from cylindrical with very long setae to broadened and flattened with very short setae giving the flagellum a serrate appearance (in some Australian species flagellum is branched); clava entire; phallobase with well developed digiti, each with one to three apical hooks.

HOSTS. Where the biology is known, all species are primary endoparasitoids of the nymphs of Psyllidae (Hemiptera: Psylloidea) (Noyes 2004).

DISTRIBUTION. A cosmopolitan genus consisting of over 200 described species. The greatest number of species occur in Australia where there are about 110 described species, with many more to be discovered (Noyes & Hayat 1984). Nearly 60 species are known from the Palaearctic region (Trjapitzin 1989), 22 species from Africa and 15 from the Oriental region (Noyes 2004).

IDENTIFICATION. The Palaearctic species have been keyed by Trjapitzin (1982, 1989), the southern African species by Prinsloo (1981), the Australian species by Riek (1961) and the Costa Rican species by Noyes & Hanson (1996). Noyes & Hayat (1984) provide a list of the species known from the Indo-Pacific region.

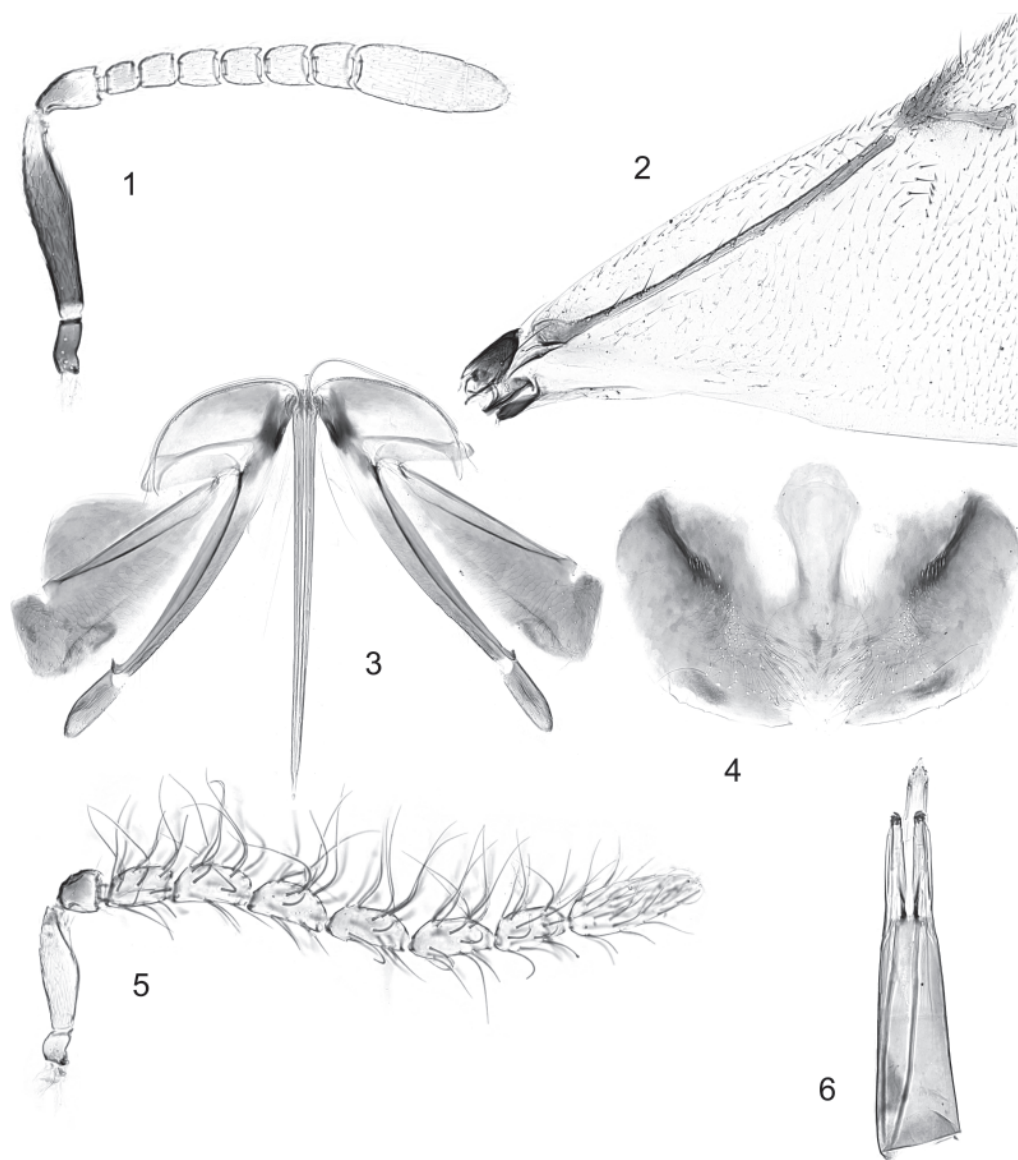
COMMENTS. *Psyllaephagus* can be confused with *Ooencyrtus* Ashmead, 1900, both genera including species that can be extremely similar in habitus and colouration. The most convenient character for distinguishing the two genera is the shape of the mesopleuron. In *Psyllaephagus* the mesopleuron does not reach level with the posterior margin of the propodeum so that in lateral view the side of the propodeum is clearly visible above the hind coxa, whereas in *Ooencyrtus* the mesopleuron extends a little past the posterior margin of the propodeum so in lateral view the side of the propodeum is not visible above the hind coxa.

Psyllaephagus zdeneki sp. nov.

(Figs 1–6)

MATERIAL EXAMINED. Holotype ♀: IRAN, Fars, 5km SW Shiraz, Bash garden, ex *Euphyllura pakistanica*, 3.viii/12.viii.2000 (lgt. M. Fallahzadeh). Paratypes: IRAN, 3♀, 2♂, same data as holotype; 3♀, 1♂, Fars, Shiraz, ex *Euphyllura pakistanica* on olive, vi.2000 (lgt. M. Fallahzadeh). Holotype and paratypes in BMNH.

DESCRIPTION. Holotype, female, length 1.37 mm. Head metallic green with a blue sheen on occiput, along occipital margin and temple dorsally, a strong purple area from a little above top of antennal scrobe to level with lower margins of antennal torulus, this not quite reaching malar suture; radicle dark brown; scape dark brown with about apical one-quarter yellow; pedicel yellow with basal half



Figs 1–6. *Psyllaephagus zdeneki* sp. nov. (paratype). (1) antenna, ♀; (2) fore wing base, ♀; (3) ovipositor; (4) hypopygium; (5) antenna, ♂; (6) genitalia, ♂.

dorsally and laterally dark brown; flagellum slightly dusky yellow; thorax dorsally concolorous with frontovertex with a very slight blue and brassy sheen, mesoscutum slightly brassy and coppery along posterior margin; tegula proximally pale yellow with apical half dark brown; mesopleuron metallic green with posterior half or so with a distinct coppery or purple sheen; metanotum dark brown; fore coxa, pale yellow, mid coxa brown, distally pale yellow, hind coxa dark brown with a slight metallic sheen, legs otherwise pale yellow; dorsum of thorax clothed in short, pale brown setae; wings virtually hyaline, but fore wing slightly infusate below marginal vein, venation brown; propodeum dark brown, sides metallic green and clothed with fairly conspicuous translucent, silvery setae; gaster dark brown with a metallic green sheen, distal segments distinctly coppery purple.

Head about $2.5\times$ as wide as frontovertex which has fine, punctate-reticulate sculpture of mesh size about $0.6\times$ diameter of eye facet; setae on frontovertex about as dense as those on dorsum of thorax, but a little less conspicuous; setae on interantennal prominence more conspicuous and denser; ocelli forming an angle of about 90° ; posterior ocellus separated from occipital margin by about its own diameter and from eye margin by slightly less; eye appearing virtually bare but clothed in numerous extremely short, pale setae, each much shorter than diameter of facet; antenna as in Fig. 1 with all funicle segments subquadrate, F5 slightly longer than broad. Relative measurements: HW 76, FV 28, POL 17, OCL 5, OOL 2, EL 43, EW 35, MS 18, SL 28, SW 8.

Thorax dorsally with fine, slightly irregular, punctate-reticulate sculpture of mesh similar to that on frontovertex but slightly larger; fore wing (Fig. 2) with basal cell more or less evenly setose throughout, but a little more sparsely proximally, linea calva interrupted and closed dorsally near posterior wing margin by a line of setae. Relative measurements: FWL 170, FWW 75, HWL 125, HWW 36.

Gaster nearly as long as head and thorax combined; hypopygium extending to about $0.8\times$ along gaster; ovipositor not exerted.

Paratype. Hypopygium (Fig. 4) broadly V-shaped with an anterior median extension; ovipositor (Fig. 3) with anterior part of second valvifer subtriangular and outer part acute; subapical notch on outer plate of ovipositor triangular. Relative measurements: OL 43, GL 9, MT 28.5.

Male, length 1.23–1.31 mm.

Generally very similar in habitus and colour to female but face entirely metallic green without any blue or purple areas except on mouth margin; scape yellow; pedicel and flagellum pale brown; fore coxa basally dark brown; ocelli forming a strongly obtuse triangle, posterior ocellus about equidistant from eye and occipital margin; antenna (Fig. 5) with all funicle segments longer than broad and clothed with long setae; fore wing with a large bare area in basal cell proximally; genitalia (Fig. 6) with apex of aedeagus tapering and pointed. Relative measurements, card-mounted specimen: OCL 4, POL 19, OOL 4; slide-mounted specimen: HW 34, FV 19, SL 9, MT 29, AL 25.

VARIATION. Very little in material available, although females vary from 1.23–1.47 mm in length and the flagellum in one female is brown.

DISTRIBUTION. Iran.

HOST. A solitary endoparasitoid of the nymphs of *Euphyllura pakistanica* (Hemiptera: Psyllidae) on olive, *Olea europaea* (Oleaceae).

COMMENTS. *Psyllaephagus zdeneki* sp. nov. is most similar to *P. tegularis* (Mercet, 1921), *P. mesohomotoma* Singh et Agarwal, 1993 and *P. solanensis* Sushil et Khan, 1995, the females of all four species having all funicle segments either quadrate or transverse and legs that are mostly yellow with only the mid and hind coxae marked with brown. The new species runs to *P. tegularis* in Trjapitzin's (1982) key to Palaearctic species, but differs from this species in having F5 longer than broad and F6 quadrate, whereas in *P. tegularis* both F5 and F6 are transverse. It differs from *P. mesohomotoma* as follows:

<i>Psyllaephagus zdeneki</i> sp. nov.	<i>Psyllaephagus mesohomotoma</i> Singh et Agarwal
(female)	(female)
HW about 2.5× frontoververtex width	HW slightly more than 3× frontoververtex width
Basal part of 2 nd valvifer of ovipositor externally tapering so that proximal part of sclerite is triangular	Basal part of 2 nd valvifer subquadrate
Subapical notch on outer plate of ovipositor triangular	Subapical notch on outer plate of ovipositor quadrate
Fore wing below marginal and stigmal veins more sparsely setose than disc of wing	Fore wing below marginal and stigmal veins with setae as dense as in wing disc
Fore wing slightly infusate below marginal vein	Fore wing completely hyaline below marginal vein
Linea calva interrupted	Linea calva entire
(male)	(male)
apex of aedeagus tapering and pointed	apex of aedeagus rounded

The triangular shape of the basal part of the second valvifer indicates that *P. zdeneki* sp. nov. may be closest to *P. solanensis*, a species that is also associated with olive. We have been unable to examine any type material of *P. solanensis* which should be in the Zoological Survey of India, Calcutta. However the description of *P. solanensis* suggests that there are significant differences as follows:

<i>Psyllaephagus zdeneki</i> sp. nov.	<i>Psyllaephagus solanensis</i> Sushil et Khan
(female)	(female)
Ocelli forming a right angle	Ocelli forming an acute angle
OCL=posterior ocellar diameter	OCL=2× posterior ocellar diameter
OOL<ocellar diameter	OOL>ocellar diameter
Scape about 3.5× as long as broad	Scape about 3× as long as broad
F1 more or less quadrate, F6 quadrate	F1 distinctly longer than broad, F6 longer than broad
Linea calva closed and interrupted	Linea calva open and not interrupted
Basal cell almost uniformly setose	Basal cell bare in proximal half

BIOLOGY. The parasitoid is active from the late spring, but the population is usually low in early spring only reaching high densities late autumn. It overwinters successfully as a pupa within the mummified nymphs of *Euphyllura pakistanica* on the leaves and shoots of olive.

A c k n o w l e d g e m e n t s

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***Metaphycus zdeneki* sp. nov. (Hymenoptera: Encyrtidae) from Peru, a
parasitoid of *Bakerius* sp. (Hemiptera: Aleyrodidae)**

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Abstract. *Metaphycus zdeneki* sp.nov, a parasitoid of a whitefly (*Bakerius* sp.) in Peru is described and characters are given to distinguish it from related species.

Taxonomy, new species, Hymenoptera, Encyrtidae, parasitoid, Hemiptera, Aleyrodidae, Neotropical region

INTRODUCTION

There are few authenticated records of Encyrtidae as parasitoids of whiteflies. To date, species of 11 genera have been recorded as whitefly parasitoids (Noyes 2004a), but many of these are probably either erroneous observations or unusual occurrences. It is possible some species that normally attack diaspidid scales or other small coccoids may develop successfully as parasitoids of aleyrodids when their usual hosts are scarce, e.g. *Metaphycus flavus* (Howard, 1881) (see Guerrieri & Noyes 2000). Other than a few, still undescribed, species of *Metaphycus* Mercet, 1917 occasionally reared from whiteflies in South America (material in BMNH) four species are known that appear to be obligatory endoparasitoids of whiteflies, i.e. *Metaphycus aleyrodus* (Myartseva et Ruiz, 2002) (Myartseva & Ruiz 2002) from Central America, *Metaphycus omega* Noyes, 2004 (Noyes 2004b) from throughout the Neotropics, *Rhopus erianthi* (Myartseva, 1994) (Myartseva 1994) from Central Asia and *Zarhopaloides anaxenor* Noyes, 2001 (Bailey et al. 2001) from Australia. It is thus possible that encyrtids utilise whiteflies as hosts more frequently than was previously thought. Recently another species has been reared in numbers from a whitefly host in Peru. Although also belonging to *Metaphycus* this species appears not to be closely related to any of the known species of this genus that parasitise whitefly hosts and therefore it is described here.

The new species is being named in honour of Zdeněk Bouček in celebration of his 80th birthday.

ABBREVIATIONS

DEPOSITORIES. BMNH – Natural History Museum, London, United Kingdom; MUSM – Museo de Historia Natural, Lima, Peru.

MORPHOLOGY. AL – aedeagus length, EL – maximum eye length, EW – maximum eye width, FV – minimum frontovertex width, FWL – fore wing length, FWW – fore wing width, GL – gonostylus (=3rd valvula) length, HW – maximum head width, HWL – hind wing length, HWW – hind wing width, MS – malar space, MT – mid tibia length, OCL – occipital-ocellar line, OL – ovipositor length, OOL –ocular-ocellar line, POL – post-ocellar line, SL – scape length, SW – maximum scape width.

TAXONOMY

Metaphycus Mercet, 1917

Metaphycus Mercet, 1917: 138 (as subgenus of *Aphycus* Mayr, 1876).

TYPE SPECIES. *Aphycus zebratus* Mercet, 1917.

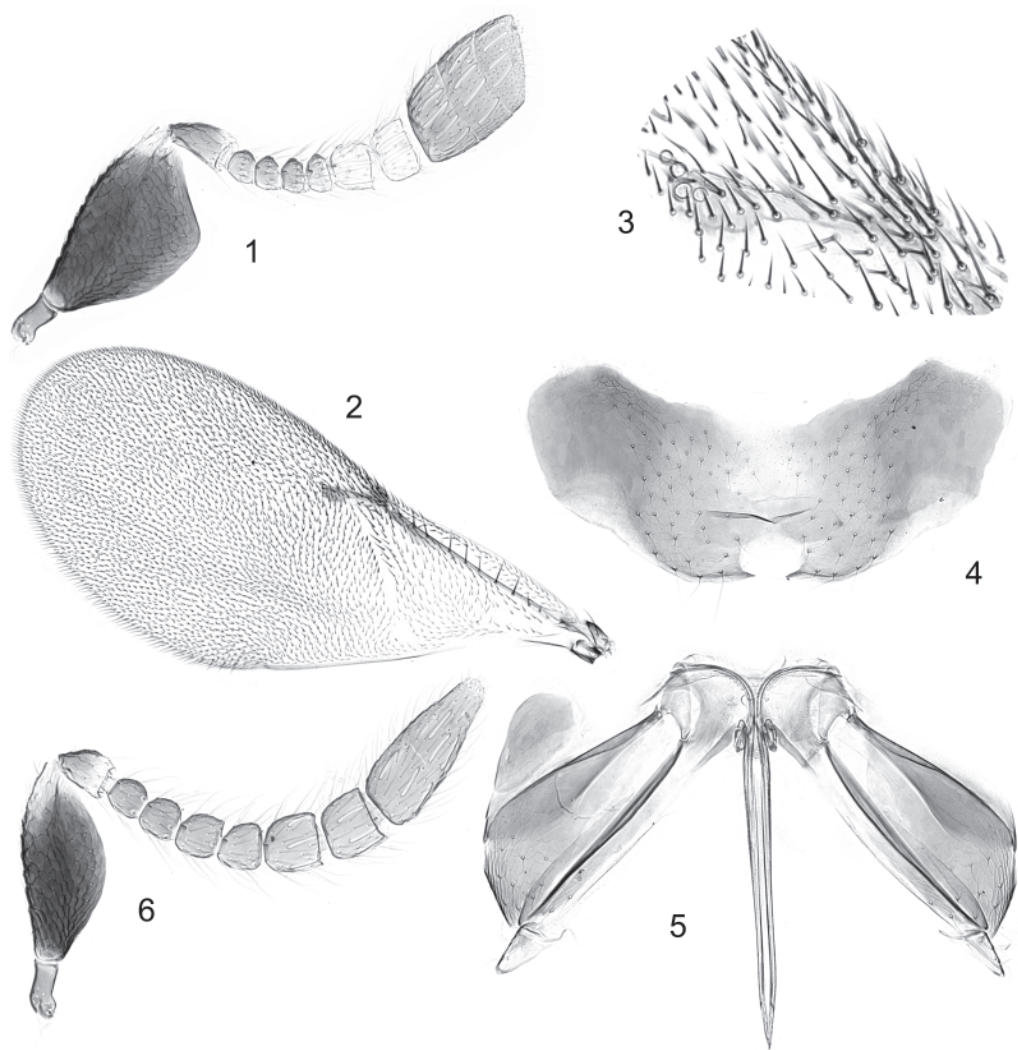
DIAGNOSIS. Length 0.5–1.8 mm. Body largely orange, yellow to brown or black, never with metallic lustre, antenna usually black or dark brown with white or yellow segments; legs yellowish or with brown to black segments, tibiae frequently with dark rings. Head with occipital margin sharp. Pronotum short, broadly triangular in dorsal view; mesoscutum wider than long, notaular lines present, but variable in length from virtually absent to complete and reaching posterior margin of mesoscutum; scutellum never with an apical flange that overhangs the propodeum medially; fore wing usually about 2.5× as long as broad, with uniform setation; submarginal vein extending about half way along wing; marginal and postmarginal veins very short, stigmal vein well developed, longer than marginal and postmarginal veins together; linea calva interrupted by at least a few setae, or completely closed in posterior third; mesopleuron not reaching posterior margin of propodeum so that propodeum is clearly visible in lateral view above hind coxa. Female: antenna usually 11-segmented (1163), rarely with clava 2-segmented; outer plates of ovipositor not reflected upwards posteriorly to connect with syntergum; gonostyli free, usually not exerted or hardly so. Male: generally darker and with more uniform colour than female. Antenna 9-segmented (1161), with setae longer than in female; toruli often with associated pores that may be sensorial or more probably glandular (see Guerrieri & Noyes 2000, Noyes 2004b).

HOSTS. *Metaphycus* species have mainly been reported as solitary or gregarious parasitoids of soft scales or armoured scales, with a few species recorded as parasitoids of Kermesidae, Asterolecaniidae, Kerridae, Eriococcidae, Cerococcidae and Pseudococcidae (Hemiptera: Coccoidea) (see Guerrieri & Noyes 2000). Three species have been reared from triozids (Hemiptera: Triozidae) and several have been obtained from whiteflies (Hemiptera: Aleyrodidae) (see Guerrieri & Noyes 2000).

DISTRIBUTION. A cosmopolitan genus consisting of over 400 described species. The greatest number of species occur in the Neotropics where there are slightly more than 200 described species, with many more to be discovered (Noyes 2004b). About 80 species are known from each of the Palaearctic (Trjapitzin 1989, Guerrieri & Noyes 2000) and Afrotropical regions (Annecke & Mynhardt 1971, 1972, 1981), 48 from the Nearctic (Gordh 1979, Noyes 2004a), 14 from the Oriental region (Noyes 2004a) and 23 from the Australasian region (Noyes & Hayat 1984, Noyes 2004a).

IDENTIFICATION. Several keys have been published to the species of *Metaphycus*: Timberlake (1916) for North American species (as *Aphycus* Mayr, 1876), Noyes (2004b) for Costa Rican species, Compere (1940) for African species, Annecke & Mynhardt (1971, 1972, 1981) for South African species, Myartseva (1987) for Russian species, Viggiani & Guerrieri (1988) for Italian species, Guerrieri & Noyes (2000) for European species; Trjapitzin (1989) for Palaearctic species and Zeya & Hayat (1993) for Indian species.

COMMENTS. In some respects females of *Metaphycus* that have the ovipositor exerted can be confused with *Aphycus*. In *Aphycus*, the linea calva of the fore wing is always entire and the outer plates of the ovipositor are reflected upward posteriorly to connect loosely with the syntergum. Some species of *Metaphycus* can also be confused with *Ooencyrtus* Ashmead, 1900, but in *Ooencyrtus* the mesopleuron extends a little past the posterior margin of the propodeum so that in profile the side of the propodeum is not visible above the hind coxa. Several other similar genera can be separated using the key provided by Noyes (2004b).



Figs 1–6. *Metaphycus zdeneki* sp. nov. (paratype). (1) antenna, ♀; (2) fore wing, ♀; (3) apex of fore wing venation, ♀; (4) hypopygium; (5) ovipositor; (6) antenna, ♂.

***Metaphycus zdeneki* sp. nov.**

(Figs 1–6)

MATERIAL EXAMINED. Holotype ♀: PERU, Huanuco, Santa Isabel, ex *Bakerius* sp. (det. J. Martin) on unknown plant, 22.x.2002 (lgt. G. Solis & P. Lozada). Paratypes, PERU, 35 ♀, 12 ♂, same data as holotype. Holotype in BMNH, paratypes in BMNH and MUSM.

DESCRIPTION. Female (holotype); length, including ovipositor, 1.11mm; excluding ovipositor, 1.08mm (air dried).

Head with occipital margin dark brown, paler brown immediately behind ocelli, ocellar area dirty white, remainder of frontovertex white; antennal scrobe dorsally white, dark brown above torulus; interantennal prominence medially white, side dark brown; area immediately around torulus whitish; temple, gena and mouth margin dark brown; eye bordered white along temple; occiput dark brown, paler brown immediately below occipital margin; antennae (Fig. 1) with radicle dark brown, scape black on both surfaces, with extreme apex white, pedicel dark brown with apical quarter pale yellow, F1–F4 dark brown, F5 and F6 white, clava dark brown; thorax mostly very dark brown, virtually black, with posterior margin of pronotum translucent, dusky white, apex of scutellum and metanotum medially pale brown, prepectus and side of pronotum white, rest of side and venter of thorax slightly paler brown than dorsum; fore leg generally very pale yellow with femur and tibia slightly dusky medially, tarsus orange-yellow, pretarsus brown; mid leg generally pale yellow, with a brown subapical mark on femur distally, mid tibia with faint to distinct brown rings at about one-fifth and three-fifths along its length, tarsus slightly darker yellow, pretarsus brown; hind coxa brown-yellow, darker proximally, femur and tibia generally pale yellow, femur broadly slightly dusky subapically, knee brown, tibia with a brown ring at about one-fifth and indication of a very faint ring at about three-fifths, tarsus darker yellow, pretarsus brown; wings hyaline, venation pale brown; propodeum dark brown, paler brown medially; gaster dark brown, visible part of ovipositor sheath pale brown.

Head with fine, punctate-reticulate sculpture on frontovertex of mesh very slightly smaller than eye facet; frontovertex with setae less dense than on dorsum of thorax, and each about as long as diameter of anterior ocellus; ocelli forming an angle of about 45°; eye clothed in dense, fine setae, each clearly shorter than diameter of facet; lateral antennal groove absent; antennal scrobes moderately deep, well-defined, v-shaped and connected dorsally; antenna (Fig. 1) with scape slightly less than 2× as long as broad; funicle with F1–F4 transverse, subequal and clearly smaller than F5 or F6; clava with a very broad, slightly oblique apical truncation which is clearly wider than F6. Relative measurements: HW 59, FV 19, POL 5.5, OCL 5, OOL 2, EL 34, EW 31, MS 23, SL 30, SW 17.

Thorax dorsally with very fine, punctate-reticulate sculpture clearly of smaller mesh than that on frontovertex; fore wing (Fig. 2) with basal cell more or less evenly setose throughout, but a little more sparsely proximally, linea calva interrupted by two lines of setae and closed near posterior wing margin by two lines of setae; marginal vein (Fig. 3) more or less punctiform; propodeum with about 15 fairly evenly distributed, conspicuous, silvery setae below spiracle.

Gaster shorter than thorax; hypopygium reaching about two-thirds along gaster; ovipositor very slightly exerted, the exerted part about 0.25× as long as mid tibial spur.

Paratype. Funicle with linear sensillae only on F5 and F6; mandible with three, very short, subequal teeth; palp formula 4–3; ovipositor as in Fig. 5; hypopygium (Fig. 4) about 2× as broad as long; second valvifer with two subapical setae. Relative measurements: FWL 76, FWW 34.5, HWL 49, HWW 12, OL 26.5, GL 4, MT 27.

Male. Length 0.82–0.98mm (air dried).

Generally very similar in habitus and colour to female but for generally much less conspicuous dark marks on legs; slightly narrower scape, more slender funicle segments, solid clava and structure of genitalia. Legs with dark markings very indistinct, appearing almost completely yellow; toruli without associated pores; antenna (Fig. 6) with scape slightly more than 2× as long as broad; all funicle segments subquadrate and clothed in setae that are about as long as diameter of segments. Relative measurements, card-mounted specimen: HW 56, FV 20, OCL 4, POL 7, OOL 3, SL 26, SW 12; slide-mounted specimen: MT 27, AL 11.5.

VARIAION. Very little in material available, although female varies from 0.84–1.03mm in length.

DISTRIBUTION. Peru.

HOST. The type series was reared from *Bakerius* sp., a relatively large species of aleurodicine whitefly (Hemiptera: Aleyrodidae), on an unknown plant.

COMMENTS. Females of *Metaphycus zdeneki* sp. nov. run to couplet 28 in Noyes (2004b) but differ from those of the three species that key there (*M. lycoris* Noyes, 2004, *M. obstinus* Noyes, 2004 and *M. dyme* Noyes, 2004) by the combination of the 4–3 palp formula and the scape being less than 2× as long as broad. The other species that run to this couplet have a 3–3 or 2–2 palp formula and the scape more than 2× as long as broad.

Acknowledgements

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***Pteroptrix bouceki* sp. nov. (Hymenoptera: Chalcidoidea: Aphelinidae)
from Italy**

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Abstract. *Pteroptrix bouceki* sp. nov. (Hymenoptera: Aphelinidae) from yellow sticky traps in Mediterranean pine-wood from Italy is described. On the basis of morphology of head and forewing the new species may be placed in the *P. maritima* group and appears most closely related to *P. confuniculata* (Huang, 1992).

Taxonomy, new species, yellow sticky traps, Hymenoptera, Aphelinidae, Mediterranean pine-wood, Palaearctic region

INTRODUCTION

Pteroptrix Westwood, 1833 is a worldwide distributed genus including 62 described species, all of which are parasitoids of diaspidid scales. Several species have been successfully used in biological control programs: the introduction of *Pteroptrix smithi* (Compere, 1953) in Israel against the Florida red scale, *Chrysomphalus aonidum* (Linné, 1758), on citrus gave positive results (Steinberg et al. 1986); *Pteroptrix japonica* (Huang, 1991) was introduced in China to control *Hemiberlesia pitysophila* Takagi, 1969 on pine (Huang 1991, Viggiani & Ren 1993); *Pteroptrix orientalis* (Silvestri, 1909), after about one century from its introduction, coexists in Southern Italy on *Pseudaulacaspis pentagona* (Targioni Tozzetti, 1886) with other parasitoids (Viggiani & Garonna 1993, Pedata & Garonna 2001).

Actually the genus *Pteroptrix*, following Viggiani & Garonna (1993) also includes species formerly described in *Archenomus* Howard, 1898. The two genera had been previously separated on the basis of the number of funicular segments (2 in *Pteroptrix*, 3 in *Archenomus*). The synonymy of the two genera was proposed by the cited authors since a partial fusion of the first two funicular segments distinctively occurs in one species, *Pteroptrix confuniculata* (Huang, 1992) and occasionally in *P. orientalis*. Thus Viggiani & Garonna (1993) considered the number of funicular segments to be at most useful, together with features of the head, mandible, forewing, male antenna and genitalia, to define subgeneric groups.

In a survey of entomophagous insects in a mixed Mediterranean coastal pine-wood we collected by yellow sticky traps several specimens of another interesting species of *Pteroptrix* with the first two funicular segments partially fused, which is herein described as new.

TAXONOMY

Pteroptrix bouceki sp. nov.

(Figs 1–8)

TYPE MATERIAL. Holotype, female (slide mounted), ITALY, Castel Volturno, V. 1995, leg. P.A. Pedata, on yellow sticky traps, Mediterranean pine-wood. Paratypes: 20 females (slide mounted), same data as holotype, 15 females (card mounted) same data as holotype. Holotype and paratypes are deposited at the Dipartimento di Entomologia e Zoologia agraria, Università di Napoli "Federico II", Portici, Italia. Some paratypes are deposited at The Natural History Museum, London, UK.

DESCRIPTION. Female. Length, 0.6–0.7 mm. Body blackish-brown; occiput and frontovertex yellow; antenna pale brown with scape dorsally and funicle notably darker; mid lobe of mesoscutum with a large blackish-brown patch extended from the anterior to the posterior margin in a broad triangular pattern, sides yellowish; side lobes of mesoscutum yellow, scutellum whitish-yellow; metanotum and propodeum centrally yellow; legs whitish with mid and hind femura (except the ends) and basal third of middle and hind tibiae distinctly darkened; fore wing palely infuscated below the entire length of marginal vein.

Head (Figs 1, 2) with a transverse sulcus on occipital surface placed well above lower eye margins and not continuous with the sulcus on the frontal side of the head, about 1.5 times as wide as frontovertex; toruli with their upper limits above the lower eye margin, separated from each other by about their own longest diameter; head with sculpture and setation as illustrated; mandible with two teeth and a broad truncation.

Antenna (Fig. 3) with scape narrow about 5 times as long as its maximum width; pedicel a little shorter than the first two partially fused funicular segment (F1–F2) (Fig. 8); F1 slightly longer than wide and a little longer than F2; third funicular segment (F3) about 1.5 times as long as broad; entire funicle a little longer than basal club segment; club slender about 3 times as long as the funicle and about 9 times as long as its maximum width; funicle devoid of linear sensilla, which are present on each club segment as follows: 2;2;3. Flagellum finely and sparsely setose.

Sculpture on mid lobe of mesoscutum as in Fig. 4, the cells broad anteriorly, becoming elongate and longitudinally orientated posteriorly; cells provided with acciculations; sculpture on side lobes and scutellum hardly discernible; scutellum about 2 times as wide as long; mid lobe of mesoscutum with 8–10 setae; scutellum with 4 setae.

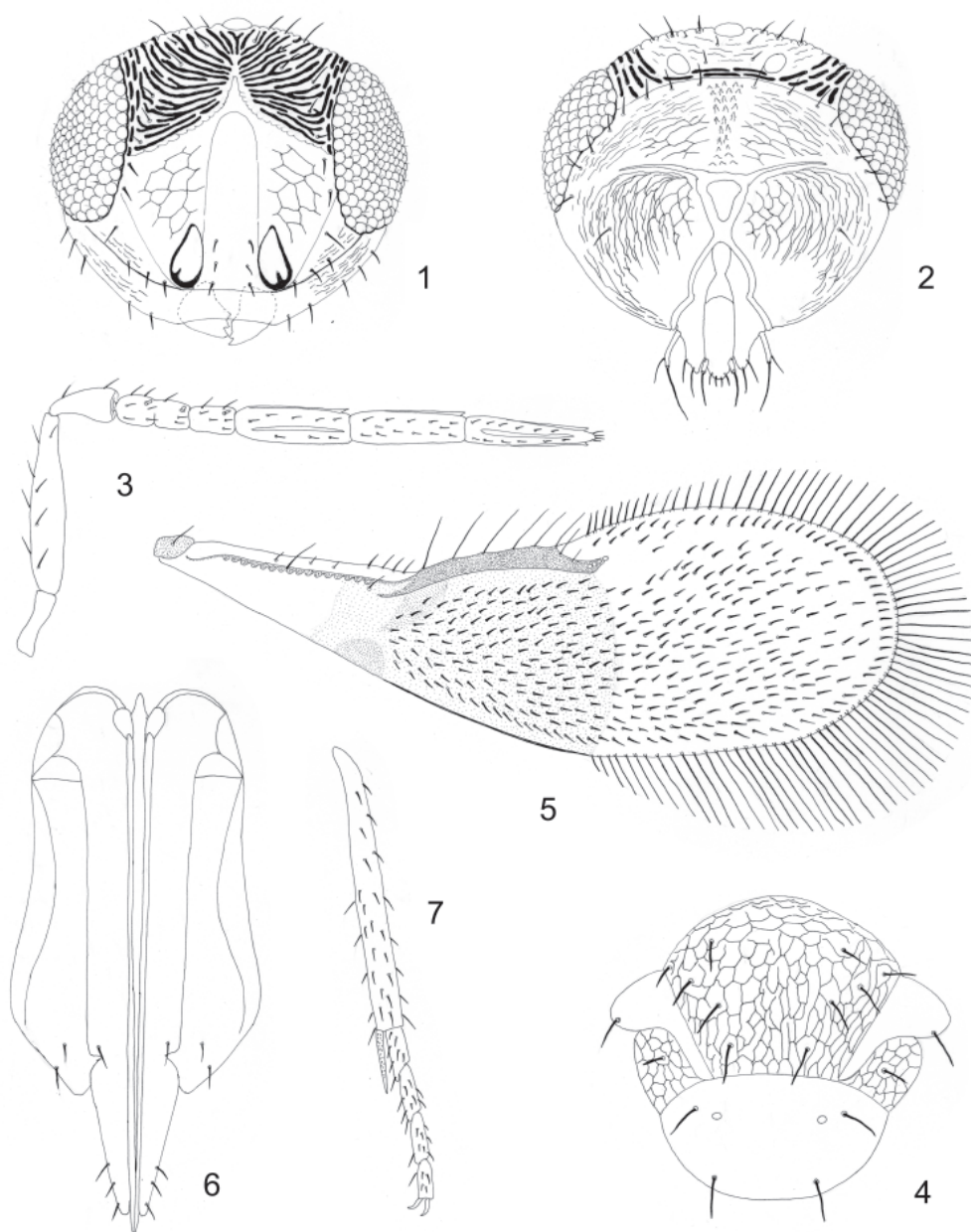
Fore wing (Fig. 5) about 3 times as long as broad; stigmal vein petiolate; marginal vein about two third the length of the costal cell, with 5–6 strong setae; apex of costal cell with a row of 3–5 setae; submarginal vein with one seta in its middle; wing disc densely setose from the level of the base of the marginal vein to the wing apex; longest marginal cilia about one half as long as the maximum width of the wing; hind wing approximately 6.6 times as long as broad, the longest marginal cilia 1.4 times as long as the width of the wing.

Ovipositor (Fig. 6) measured from the apex of the II valvifer to the tip of gonostyli about 2 times as long as the middle tibia (Fig. 7), 3.2–3.5 times as long as gonostyli; the latter about twice the length of mid tibial spur which is a little longer than the corresponding basitarsus.

Male. Unknown.

BIOLOGY. Unknown.

COMMENTS. *Pteroptrix bouceki* sp. nov. closely resembles *Pteroptrix confuniculata* (Huang, 1992) in most structural characters as well as in colour. However the two species differ clearly in the relative dimensions of the antennal segments, number of antennal sensilla and length of ovipositor relative to middle tibia. In *P. confuniculata* F3 is subquadrate, the club is 5 times as long as its maximum width, 2.2 times as long as the funicle, number of sensilla on club segments as follows: 4–6; 4–5; 3 and ovipositor about 1.3 times as long as middle tibia. As *P. confuniculata*, this new



Figs 1–7. *Pteroptrix bouceki* sp. nov., female. 1 - head, front view; 2 - head, rear view; 3 - antenna; 4 - mesonotum; 5 - fore wing; 6 - ovipositor; 7 - mid tibia.

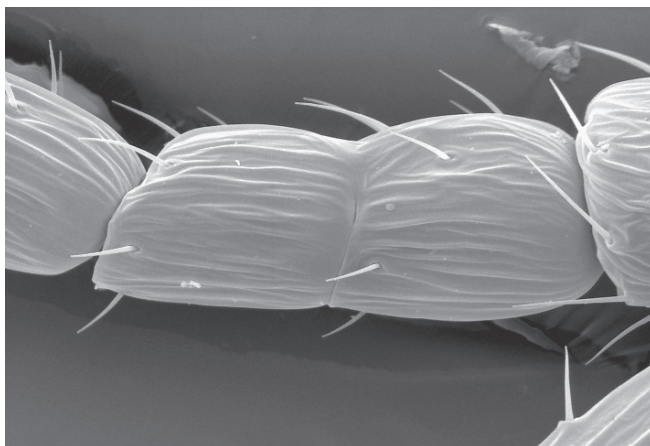


Fig. 8. *Pteroptrix bouceki* sp. nov., female. Particular at SEM showing partial fusion of first two funicular segments.

species can be placed in the *P. maritima* group Viggiani & Garonna, 1993 for the features of the transverse sulcus of the head and the petiolate stigmal vein.

The new species shows very little variations in the examined material. Smaller individuals have fewer setae (4–6) on the mid lobe of mesoscutum.

ETYMOLOGY. The species is named in honour of Dr Zdeněk Bouček in celebration of his 80th birthday and in recognition of his contribution to the study of systematics of Chalcidoidea.

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Revision of the genus *Perthiola* (Hymenoptera: Eulophidae: Anselmellini) with the description of a new species

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Abstract. The genus *Perthiola* Bouček, 1988 (Hymenoptera: Eulophidae) is reviewed and a key is provided to the three known species: *P. mazaneci* Bouček, 1988, *P. bouceki* sp. nov., and *P. moringae* (Narendran, 2003) comb. nov. from *Manipurella* Narendran, 2003. The genus *Manipurella* is synonymised with *Perthiola* syn. nov. The first biological records are given for *Perthiola*, which is associated with galls, as well as the first description of a male of the genus.

Taxonomy, new species, new combination, synonymy, distribution, key, Hymenoptera, Chalcidoidea, Eulophidae, Anselmellini, *Perthiola*, Australian region, Oriental region

INTRODUCTION

The group Anselmellini (Hymenoptera: Eulophidae), erected as a tribe by Bouček (1988), includes two genera: *Anselmella* and *Perthiola* (Bouček 1988, Gauthier et al. 2000, Noyes 2003). This tribe is easily recognized by having: radicle long (at least twice as long as broad) (Figs 3, 7), 9-segmented flagellum (Figs 3, 7), notauli complete to posterior margin of mesoscutum (Fig. 2), marginal vein thickened along length and usually shorter (or sometimes slightly longer) than stigmal vein (Figs 5, 6), toruli distinctly above middle of head (Figs 1, 8), and tentorial pits distinct and deep (Figs 1, 8). Bouček (1988) placed the Anselmellini in the subfamily Eulophinae; however, Gauthier et al. (2000) found placement of this tribe to be ambiguous within the 4 subfamilies currently recognized in the Eulophidae, and they left it as an unplaced tribe. *Anselmella* Girault, 1926 (as *Eugeniana* Narayanan, Subba Rao et Patel, 1958) was classified in the family Pteromalidae (Hymenoptera: Chalcidoidea) (Narayanan et al. 1958), and only subsequently transferred to Eulophidae by Bouček et al. (1979), because individuals have 4 instead of 5 tarsal segments.

Anselmellini appears closely related to Ophelimini [another unplaced tribe of Eulophidae, according to Gauthier et al. (2000)]. Members of both these tribes have, in particular, a widened marginal vein, and also more antennal segments than is usual for eulophids. They are also mainly phytophagous, and seem to be predominantly native to the Australasian Region (Bouček 1988). Possibly, they are related, perhaps as a monophyletic assemblage or as a grade between Euderinae and Entedoninae (Eulophidae) (Gauthier et al. 2000, La Salle in press). However, Ophelimini may be distinguished from Anselmellini by having antenna with less than 9 distinct flagellar segments, radicle short (less than twice as long as broad), and marginal vein distinctly longer than stigmal vein (Bouček 1988).

In this paper, a review of the genus *Perthiola* is presented, as well as a key to females of the three known species: *P. mazaneci*, *P. bouceki* sp. nov., and *P. moringae*. The genus *Manipurella* is synonymised with *Perthiola*. New distributional and host notes for *Perthiola* are presented, as well as the first record and description of males for the genus.

MATERIAL AND METHODS

The following codes identify the collections housing the material examined:

ANIC – Australian National Insect Collection, CSIRO Entomology, Canberra, Australia;
BMNH – The Natural History Museum, London, United Kingdom;
NZSI – National Zoological Collection, Zoological Survey of India, Calcutta, West Bengal, India;
QM – Queensland Museum, Brisbane, Queensland, Australia;
SAM – South Australian Museum, Adelaide, South Australia, Australia;
USNM – National Museum of Natural History, Washington D.C., USA;
WAMP – Western Australian Museum, Perth, Western Australia, Australia.

Specimens of the newly described species “*Perthiola bouceki* Reina & La Salle” are provided with one red label for the holotype; yellow labels are provided for the paratypes, with the sex specified. Exact label data are also cited.

TAXONOMY

Genus *Perthiola* Bouček, 1988

Perthiola Bouček, 1988: 602; type species: *Perthiola mazaneci* Bouček, 1988 (by original designation).

Manipurella Narendran in Narendran, Singh et Prasad, 2003: 23; type species: *Manipurella moringae* Narendran in Narendran, Singh et Prasad, 2003 (by original designation); **syn. nov.**

DIAGNOSIS. Flagellum 9-segmented; flagellar segment 1 subequal or shorter than segment 2. Radicle at least twice as long as broad. Head with scrobes shallow and divided only ventrally. Marginal vein thickened and distinctly shorter than postmarginal vein (0.3–0.4 times as long as postmarginal vein). Notauli deep and complete to posterior margin of mesoscutum. Scutellum without longitudinal lines and with 2–5 pairs of short setae. Petiole short.

BIOLOGY. Bouček (1988) had no host information for *P. mazaneci*, although he suspected that it was phytophagous. *P. moringae* was reared from leaf galls on *Morinda angustifolia* (Rubiaceae) and *Perthiola bouceki* sp. nov. was reared from stem galls on ?*Baeckea* sp. (Myrtaceae). It is uncertain whether *Perthiola* is actually a phytophagous gall inducer, an inquiline, or a parasitoid of a gall inducer.

DISTRIBUTION. Known from Western Australia and India.

DISCUSSION. *Perthiola* is one of two genera in the Anselmellini. Bouček (1988) gave features for separating these genera, and these are repeated in our key to *Perthiola* species below.

In his revision of the Australasian Chalcidoidea genera, Bouček (1988) described the tribe Keryini and placed it within Eulophidae mainly because it had 4 tarsal segments. He noted, however, that certain features, as the 12-segmented antenna and the unusual long wing veins, were uncharacteristic of eulophids. The Keryini was removed from the Eulophidae by Gauthier et al. (2000) based on molecular evidence. Narendran et al. (2003) placed *Manipurella* in Keryini, mainly because the antenna was apparently counted 12-segmented (excluding radicle) as in Keryini. Antennal features can be difficult to count in this group (see below), and our examination of the holotype of the type species, *Manipurella moringae*, showed that it agrees in every way with the diagnostic features for *Perthiola*, and has an 11-segmented (not 12-segmented) antenna. Therefore we consider *Manipurella* as a new synonym of *Perthiola*.

MORPHOLOGICAL CONSIDERATIONS. As stated above, the number of antennal segments can be difficult to interpret in the Anselmellini. The radicle (Figs 3, 4, 7) is quite long, sometimes as long as the scape itself, which is quite rare in Chalcidoidea and may therefore be counted inadvertently as a segment. Also, the flagellum in Eulophidae is usually divided into anelli (although they can sometimes be absent), funicle and club (Gibson 1997); this is not the case for the Anselmellini. The first flagellar segment(s), although lacking sensilla, are elongate and not anelliform, and can grade into

the following segments. The club can also be difficult to distinguish from the funicle. For these reasons, we treat all the antennal segments beyond the pedicel as the flagellum, and do not try to assign them to anelli, funicle or club.

The term spectral vein is used in the key and description for lines extending distally from the apex of the stigmal vein (Mason 1986). These lines are not tubular veins, but appear as slightly folded areas in the forewing that are slightly darkened and more densely setose than the surrounding areas (Fig. 5).

Key to the female species of *Perthiola*

1. Postmarginal vein shorter than marginal vein (Fig. 6); scrobes deep and divided for entire length by median est (Fig. 8); flagellar segment 1 longer than segment 2 (Fig. 7). *Anselmella* Girault
- Postmarginal vein longer than marginal vein (Fig. 5); scrobes shallow, divided only just above level of toruli (Fig. 1); flagellar segment 1 subequal or shorter than segment 2 (Fig. 3). *Perthiola* Bouček
- 2
2. Forewing without spectral veins radiating from stigmal vein. Scape equal in length to radicle. Protibial spur slightly longer than tarsomere 1. *P. moringae* (Narendran)
- Forewing with at least one spectral vein radiating from stigmal vein (Fig. 5). Scape longer than radicle (Fig. 3). Protibial spur shorter than tarsomere 1. 3
3. Forewing with 1 spectral vein radiating from stigmal vein. Radicle twice as long as broad, about 0.4 times as long as scape, and half as long as pedicel. *P. mazaneci* Bouček
- Forewing with 2 spectral veins radiating from stigmal vein (Fig. 5). Radicle 4.0 times as long as broad, about 0.7 times as long as scape, and subequal in length with pedicel (Fig. 3). *P. bouceki* sp. nov.

Perthiola bouceki sp. nov.

(Figs 1–5)

DIAGNOSIS. Body mainly black with antenna, tibiae and tarsomeres 1–3 brown. Forewing with two spectral veins extending from stigmal vein to distal margin of wing. Radicle about 4.0 times as long as broad, about 0.7 times as long as scape and subequal in length with pedicel. Flagellar segment 1 about 0.7 times as long as flagellar segment 2. Scape not extending above top of vertex. Protibial spur half as long as tarsomere 1. Postmarginal vein about 3.0 times as long as marginal vein.

Female. Length 1.7–2.1 mm. Body black; antenna, tibiae and tarsomeres 1–3 brown. *Head* (Fig. 1). Vertex slightly vaulted, about 0.2 times eye length above eye. Face slightly sculptured, with short pilosity and without sutures. Malar space about 0.5–0.6 times eye length, without fovea. Malar sulcus absent. Tentorial pits distinct and placed ventral to lower level of eye. Clypeus with anterior margin lobate, without distinct teeth. Mandible bi-dentate. Antenna (Fig. 3). Antennal insertion high on face, above level of middle of eye. Radicle about 4.0 times as long as broad, about 0.7 times as long as scape, and subequal in length with pedicel. Scape about 4.0 times as long as wide, shorter than eye height, and not extending above top of vertex. Pedicel 0.6–0.7 times as long as scape. Flagellar segments ratio: 9/13/12/10/11/13/10/12/11. *Mesosoma* (Fig. 2). Slightly sculptured. Pronotum large laterally, but very short medially: in dorsal view 0.1–0.2 times as long as mesoscutal medially. Notauli deep and complete to posterior margin of mesoscutum. Mesoscutum and scutellum subequal in length. Midlobe of mesoscutum with 2 adnotaular setae in posterior half. Scutellum about 1.2 times as long as broad; with 5 pairs of short setae. Dorsellum very short: 0.1–0.2 times as long as scutellar length. Propodeum with indistinct median carina; spiracle placed midway between anterior and posterior margins; callus with 5–6 setae. *Forewing* (Fig. 5). About 2.4 times as long as broad, and uniformly covered with short setae. Submarginal vein with 4–6 dorsal setae. Marginal vein slightly longer (1.1 times) than stigmal vein and 0.3–0.4 times as long as postmarginal vein. Two spectral veins extending from stigmal vein to distal margin of wing.

Wing slightly and evenly darkened beyond level of parastigma, and with a darker transverse brown area behind parastigma. *Legs*. Protibial spur half length of tarsomere 1; protibia with dorsoapical margin bearing two distinct spines or protruberances. *Metasoma*. Ovate, about 0.8 times as long as head and mesosoma combined. Cerci with several short and subequal setae.

Male. Length 1.7–1.8mm. Similar to female except for antenna (Fig. 4), which is long and may extend as far as the propodeum. Radicle extending to apex of vertex and equal in length with scape. Antennal segments ratio (including radicle, scape, pedicel and 9 flagellar segments): 26/26/17/5/10/11/11/11/13/11/12/11.

ETYMOLOGY. It is our pleasure to name this species in honour of Zdeněk Bouček, who has served as a father figure for an entire generation of chalcidologists.

BIOLOGY AND DISTRIBUTION. This species emerged from stem galls on ?*Baeckea* sp. (Myrtaceae) in Western Australia.

TYPE MATERIAL. Holotype ♀: Australia, 2000, Western Australia, near Frenchman's Bay, roadside 34°56.92'S 117°59.69'E, coll. by KA Davies, 5.xi.2000, ex ?*Baeckea* sp (ANIC). Paratypes 2 ♂, 25 ♀, deposited as follows: same data as holotype (5♀ ANIC, 4♀ BMNH, 4♀ QM, 5♀ SAM, 2♀ USNM, 5♀ WAMP); Australia, 2000, Western Australia, near Denbarken Nature Reserve, 34°50.18'S 117°24.30'E, coll. by KA Davies, 7.xi.2000, ex ?*Baeckea* sp (10 ANIC, 10 WAMP).

COMMENTS. No substantial variation was observed among the type series.

As suggested in the key, *Perthiola bouceki* sp. nov. is distinguished from the other two species of the genus (*P. mazaneci* and *P. moringae*, see below) by having 2 spectral veins extending from the stigmal vein (only 1 in *P. mazaneci*, absent in *P. moringae*), scape 1.4 times as long as radicle (2.5 times in *P. mazaneci*, equal in *P. moringae*), pedicel subequal in length with radicle (pedicel twice as long as radicle in *P. mazaneci* and 0.4–0.5 times as long in *P. moringae*), and protibial spur 0.5 times as long as tarsomere 1 (about 1.1 times in *P. moringae*, 0.6 times in *P. mazaneci*).

Perthiola bouceki sp. nov. shows sexual dimorphism. As observed in many eulophids, *P. bouceki* sp. nov. male and female can be distinguished by having different antennal features. The male antenna is long and may extend as far as the propodeum, and the radicle, which is equal in length with scape, extends to apex of vertex. The female antenna does not extend to propodeum, and the radicle, which is about 0.7 times as long as scape, does not extend to apex of vertex.

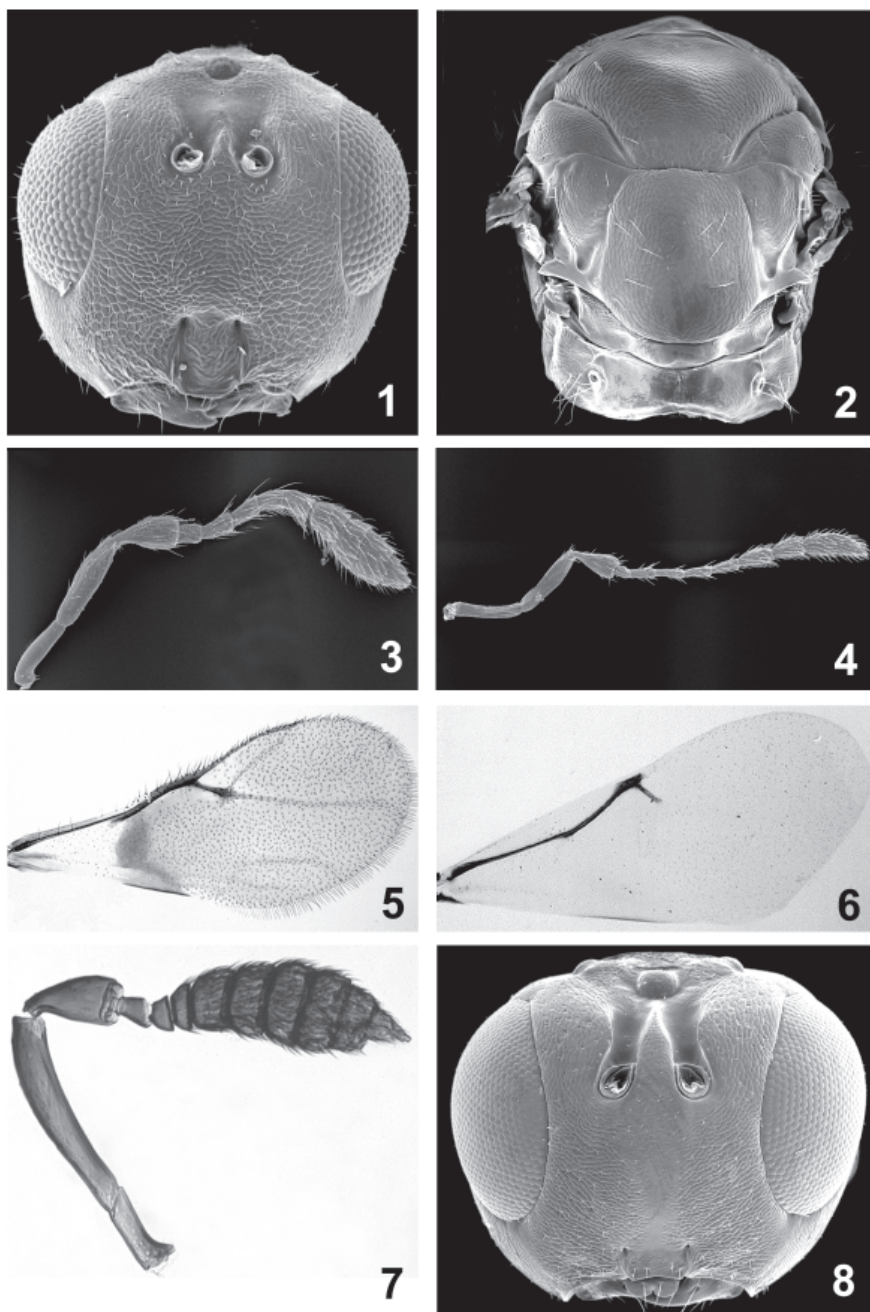
***Perthiola moringae* (Narendran in Narendran, Singh et Prasad, 2003) comb. nov.**

Manipurella moringae Narendran in Narendran, Singh et Prasad, 2003: 24 (original description).

TYPE MATERIAL EXAMINED. Holotype ♀, India, Manipur, Trilbung, coll. Ranjit Singh, 14.xi.2002; ex leaf galls of *Morinda angustifolia* Roxb. (Rubiaceae) (NZSI).

DIAGNOSIS. Body mainly blackish with antenna and legs (except coxae) brown. Forewing without spectral veins extending from stigmal vein. Scape extending beyond vertex. Radicle equal in length to scape, 6.0–6.5 times as long as broad, and 2.1 times as long as pedicel. Flagellar segment 1 0.6 times as long as segment 2. Protibial spur slightly longer than tarsomere 1. Postmarginal vein about 3.0 times as long as stigmal vein.

COMMENTS. The species is recorded from *Morinda angustifolia* Roxb. (Rubiaceae) [not *Moringa angustifolia* Roub (Rubinacea) (see Narendran et al. 2003)]. The placement of the propodeal spiracles are different from that reported and illustrated in the description: they are in fact about midway between the anterior and posterior margins of the propodeum, and not adjacent to the anterior margin. Antennal segment ratio (including radicle, scape, pedicel and 9 flagellar segments): 19/19/9/3/5/5/6/6/6/5/6/5. There are 9 flagellar segments, not 10 as shown in the illustration in the original description.



Figs 1–8. *Perthiola bouceki* sp. nov. (1–5): 1 – head, frontal view; 2 – thorax, dorsal view; 3 – female antenna; 4 – male antenna; 5 – female forewing. *Anselmella miltoni* Girault (6–8): 6 – female forewing; 7 – female antenna; 8 – head, frontal view.

Perthiola mazaneci Bouček, 1988

Perthiola mazaneci Bouček, 1988: 602.

TYPE MATERIAL EXAMINED. Holotype ♀, Australia, Western Australia, “Melaleuca” Natural Park 30 km N of Perth, 18.xi.1982 (Bouček) (ANIC).

DIAGNOSIS. Body mainly dark brown, with very faint dark greenish tinge. Forewing with one spectral vein extending from stigmal vein to distal margin of wing. Radicle twice as long as broad, 0.4–0.5 times as long as scape, and about half as long as pedicel. Flagellar segment 1 subequal in length to segment 2. Scape not reaching vertex. Protibial spur 0.6 times as long as tarsomere 1. Postmarginal vein 2.5 times as long as stigmal vein.

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Review of Nearctic *Aulogymnus* (Hymenoptera: Eulophidae) with nomenclatural changes

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Abstract. The taxonomy of the Nearctic species of *Aulogymnus* Förster, 1851 (Hymenoptera: Eulophidae) is revised. Five new species of *Aulogymnus* are described and illustrated: *A. bouceki* sp. nov., *A. gorditus* sp. nov., *A. purpurescens* sp. nov., *A. smithi* sp. nov., and *A. virginensis* sp. nov. Lectotypes are designated for *A. flavimaculata* Girault, 1916, *A. flavitibiae* Girault, 1916, *A. io* Girault, 1916, and *A. marilandia*. *Aulogymnus marilandia* Girault, 1917 is synonymized with *A. io*. Most host records reflect a specialization by *Aulogymnus* spp. on gall wasps (Hymenoptera: Cynipidae), which form galls on various oaks (Fagaceae: *Quercus* spp.). A key to Nearctic species is given and host use is summarized.

Taxonomy, new species, synonymy, lectotype designation, Hymenoptera, Eulophidae, *Aulogymnus*, Cynipidae, galls, parasite, Nearctic region.

INTRODUCTION

In this paper we redescribe the five known Nearctic species of *Aulogymnus* and describe five new species recently discovered in this region. This genus is known throughout the Nearctic region, and, where known, parasitizes gall wasps (Hymenoptera: Cynipidae) on oak (Fagaceae: *Quercus* spp.)

Aulogymnus contains 31 species worldwide with 5 previously described in the Nearctic region (Noyes 2002). Recent treatments have focused only on the Iberian and Chinese faunas (Pujade 1991, Zhu et al. 1999) but Nearctic species have never been revised. Species are robust and some specimens are very large for Eulophidae measuring up to 5 mm. They are often among the most colorful of eulophine genera with species such as *A. io* and *A. smithi* sp. nov. exhibiting a rich mix of metallic blue/green with orange to citrine coloration (Figs. 13–15). *Aulogymnus* can be distinguished by the following: color often metallic green, purple, or blue, matte yellow or orange, or a combination of the two; clypeus bilobed; mesotibia with spur as long as or longer than mesobasitarsus (Fig. 8); notauli complete, straight (Fig. 1); funicle 2 or 3 segmented (Figs. 3, 7) although some males have 4; forewing with stigmal vein elongated and uncus separated from apex (Figs. 9–12), submarginal vein generally longer than marginal, larger species often with admarginal infuscate areas. Species of *Aulogymnus* are most easily confused with *Cirrospilus* Westwood, 1832. The two genera often have similar coloration, but *Cirrospilus* species typically have a 2-segmented funicle in the female. *Cirrospilus* do not generally have a bilobed clypeus and the stigmal vein is shorter with the uncus placed near the end of the vein. *Cirrospilus* generally have a transverse groove on the frons whereas in *Aulogymnus* this groove is sometimes missing, indicated by a color change, or present in some species. All these characters are subject to variation and it has been suggested that morphologically, the two groups may grade into one another (Gauthier et al. 2000). However, most *Cirrospilus* spp. with known biologies are associated with leaf miners and all *Aulogymnus* spp. are parasitic on cynipids, usually on oak

(*Quercus* spp.), with the exception of two unusual records from Gracillariidae and Scolytidae (Bouček & Askew 1968). These distinctive biologies lead us to retain the two groups as separate genera at this time.

MATERIAL AND METHODS

In the descriptions, structures not visible on the holotype but shown in the figures are indicated by brackets ([]). Lectotypes are designated to preserve nomenclatural stability per ICZN Article 74.7 (ICZN 1999) by establishing a type specimen to serve the name-bearing function for that taxon. A Nikon SMZ1500 stereomicroscope with 10X (Nikon C-W10X/22) and Chiu Technical Corp. Lumina 1 FO-150 fiber optic light sources were used for card- and point-mounted specimen observation. Mylar film was placed over the ends of the light source to reduce glare from the specimen. Scanning electron microscope (SEM) images were taken with an Amray 1810 (LaB6 source). Specimens were cleaned of external debris with bleach after Bolte (1996) and affixed to 12.7 X 3.2 mm Leica/Cambridge aluminum SEM stubs with Scotch™ 665 double-sided tape. Stub-mounted specimens were sputter coated using an Cressington Scientific 108 Auto with a gold-palladium mixture from at least three different angles to ensure complete coverage (~20-30nm coating). Wing and habitus TM images were prepared using an Auto-Montage image capture system (Microbiology International, Synchronoscopy). With this system, digital images were captured from a stereoscope (Leica M400) by using a JVC 3-CCD Color Video Camera (Model No. KY-F55B) affixed to the microscope phototube and connected to the AutoMontage™ computer system. Abbreviations used are: CA (California), DC (District of Columbia), MA (Massachusetts), MN (Minnesota), VA (Virginia), WV (West Virginia), MPS (multiporous plate sensilla), F1-F3 (funicular segments 1, 2, or 3), G_n (gastral tergite_{number}), USNM (National Museum of Natural History, Smithsonian Institution, Washington, D.C.), BMNH (The Natural History Museum, London).

TAXONOMY

Genus *Aulogymnus* Förster, 1851

- Aulogymnus* Förster, 1851: 24; type species *Aulogymnus aceris* Förster, by monotypy.
Olynx Förster, 1856: 72; type species *Ichneumon gallarum* Linnaeus, by original designation; synonymized with *Aulogymnus* by Bouček 1965: 551.
Cyniphoctonus Reinhard, 1858: 22; type species *Ichneumon gallarum* Linnaeus, by original designation; synonymized with *Aulogymnus* by Bouček 1968: 28.
Olinx Reinhard, 1858: 22; emendation.
Ophelinoideus Ashmead, 1904: 163; type species *Ophelinoideus japonicus* Ashmead, by original designation; synonymized with *Aulogymnus* by Kamiyo 1976: 482.
Scotolinx Ashmead, 1904: 354; type species *Scotolinx gallicola* Ashmead, by original designation; synonymized with *Aulogymnus* by Bouček 1988: 609.
Pseudiglyphella Girault, 1913: 255; type species *Pseudiglyphella caelestis* Girault, by original designation; description modified Girault 1915: 264; synonymized with *Aulogymnus* by Bouček 1988: 609.
Mirolinx Girault, 1916a: 131; type species *Mirolinx flavitibiae* Girault, by original designation; synonymized with *Aulogymnus* by Schauf and LaSalle 1993: 491.
Pseudolinx Girault, 1916b: 152; type species *Pseudolinx io* Girault, by original designation; synonymized with *Aulogymnus* by Schauf and LaSalle 1993: 491.
Scotolinx Ashmead, 1904: 354; type species *Scotolinx gallicola* Ashmead, by original designation and monotypy; synonymized with *Aulogymnus* by Bouček 1988: 609.
Scotolinx Girault, 1916c: 218–219; type species *Scotolinx gallicola* Girault, by original designation; based on same material as *Scotolinx gallicola* Ashmead; synonymized with *Aulogymnus* by Bouček 1988: 609.

Key to Nearctic species of *Aulogymnus*

- 1 Color of head and body predominately yellow (see diagnosis in Introduction).....2
- Color of head and body predominately metallic blue, purple, or green.....3
- 2 Uncus >3.0× its length from apex stigmal vein; occipital maculation only surrounds occipital foramen laterally to eye (eastern USA).....*A. smithi* sp. nov.

- Uncus <3.0× its length from apex stigmal vein; occipital maculation extends laterally to eye (western USA).....*A. californica* Gordh.....6
- 3 Antenna with two funicular segments (Fig. 7) [3 in male *A. purpurescens*].....6
- Antenna with three funicular segments (Fig. 3) [male unknown].....4
- 4 Submedian lines of scutellum apparently absent; forewing asetose posterobasad parastigma.....*A. virginiensis* sp. nov.....5
- Submedian lines of scutellum present, though may be faintly indicated; forewing setose posterobasad parastigma, at least with basal and cubital setal lines (Figs. 7-12).....5
- 5 Flagellomeres robust with dense MPS (Fig. 3); submedian lines of scutellum faintly indicated by slight differences in color and sculpture, scutellum flat.....*A. bouceki* sp. nov.....7
- Flagellomeres gracile with discretely spaced MPS; submedian lines of scutellum distinct, scutellum rounded dorsally.....*A. flavitibiae* (Girault).....7
- 6 Head and body primarily dark with metallic purple reflections; metacoxa with smooth to very finely lineolate sculpturing; callus with <10 setae.....*A. purpurescens*, sp. nov.....7
- Not with above combination of characters: head and body dark metallic blue and/or green, often with areas of orange; metacoxa with coarser imbricate to reticulate sculpturing; callus with up to 18 setae.....7
- 7 Head and body primarily metallic greenish, lacking orange or yellowish in part; scutellum overhanging dorsellum apically.....*A. minyas* (Walker).....8
- Head and body primarily metallic blue/green with orange or yellowish in part; scutellum continuous with or minutely overhanging dorsellum apically.....8
- 8 Gaster elongate, 4.0× as long as broad.....*A. flavimaculata* (Girault).....9
- Gaster not elongate, <2.0× as long as broad.....9
- 9 Clava circular in lateral view, ~1.2× as long as broad.....*A. gorditus* sp. nov.....9
- Clava elongate in lateral view, >1.5× as long as broad.....*A. io* (Girault).....9

***Aulogymnus bouceki* sp. nov.**

(Figs 1–4, 15)

DIAGNOSIS. This species has three funicular segments, but is unlikely to be confused with the other *Aulogymnus* (*A. virginiensis* and *A. flavitibiae*) having three funiculars as *A. bouceki* has a flat scutellum with submedian lines faintly indicated by slight differences in color and sculpture, whereas the submedian lines are absent on the flat scutellum of *A. virginiensis* sp. nov., but present on the dorsally rounded scutellum of *A. flavitibiae* sp. nov.. The funiculars of *A. bouceki* sp. nov. are more robust with denser MPS (Fig. 3) than either *A. virginiensis* or *A. flavitibiae*.

DESCRIPTION OF FEMALE. Body length 5.60 mm (Fig. 15). Color: metallic green with blue (prepectus, coxae) or bronze (mesoscutum, scutellum, dorsellum, propodeum dorsally) reflections; or yellow as follows: circumocular strip, interconnected both dorsally by strip extending posterad lateral ocelli and anteriorly by irregular, transverse strip at level of midpoint of medial ocular margin, this strip angling dorsad along scrobes before uniting into thin line that intercepts median ocellus broadly along its anterior margin; face and genae ventrad toruli; scape, apex pedicel; lateral edge and posteromedial edge of lateral lobe mesoscutum, axillae anterolaterally, tegulae, axillulae; legs; wing veins pale yellow basally becoming brown apically, infusate admarginally between parastigma and stigmal vein with remainder of wing beyond basal setal line suffused with brown. Sculpture: face finely imbricate-reticulate ventrally becoming slightly coarser dorsally, scrobes similarly sculptured. Mesosoma, propleuron, mesepisternum (anterior to femoral depression), coxae, and metasoma reticulate-imbricate; prepectus and lateral pronotum coarsely reticulate; propodeum finely reticulate with some rugulosity along anterior margin, reticulation finest medially, with distinct median carina; prosternum pentagonal, reticulate-imbricate with fine median channel; procoxa convex anteriorly, imbricate, with sparse, erect setae along anterior surface; mesepisternum imbricate-reticulate, in ventral view with median line extending length, sparsely setose apically; scutellum reticulate and lacking shallow submedian lines, interstices conspicuous; certain areas

polished or polished with faint reticulation: dorsellum anterior spiracle, Gt₁; or with reticulation shallower than on dorsum of mesosoma: acropleuron, mesepimeron, metapleuron, and gaster. Head: 0.71× as high as broad, eye height 2.11× malar space; malar sulcus curved (Fig. 2); scrobal depression shallow, scrobes uniting at mid-frons before intercepting median ocellus; transverse frontofacial suture absent; clypeal apex shallowly bilobate; ratio lateral ocellus:ocellular distance:postocellar distance as 9:14:22. Antenna: scape reaching just above venter of midocellus; funiculars and club robust, densely covered in MPS (Fig. 3); ratio scape (minus radicle):pedicel:anellus:F1:F2:F3:club as 40:10:4:22:17:16:25; F1-F3 each subequal in width along length, clava slightly asymmetric apically. Mesosoma: pronotum and mesoscutum with evenly scattered subdecumbent setation (Fig. 1), mesoscutum bare medially with stoutest setae near apical margin, scutellum with six pairs sublateral, stout, subdecumbent setae, two pairs in anterior quarter and two pairs near midline scutellum, one pair near apex, all oriented posteromedially; prepectus triangular, >2.0× size of tegula, surface sculpture similar to lateral pronotum; propodeal spiracle ovate and positioned <1/2 its diameter from dorsellum, median carina present in anterior half, distinctly carinate; callus with 5 erect setae; mesotibia with robust seta apicoposteriorly, at least 2.00X longer than any seta on mesotibia; metacoxa 1.60× as long as broad, 0.70× as long as metafemur; metafemur 3.29× as long as broad; ratio marginal vein:postmarginal vein:stigmatal vein as 130:45:33; basal setal line present and cubital setal line terminating at apex basal setal line; costal cell with row of 5 marginal setae anterior parastigma, one longitudinal row of setae ventrally extend entire length costal cell, uncus 2.00× its length from apex stigmatal vein. Metasoma: elongate, ovate in dorsal view, tapered apically where ovipositor sheaths slightly extruded (Fig. 4); gastral petiole visible as transverse, transparent strip in dorsal view, Gt₂ - Gt₇₊₈, ovipositor sheath (all measured dorsally): 30:10:13:17:18:26:??:7; cerci peg-like, roughly as long as broad.

Male. Unknown.

ETYMOLOGY. Named in honor of Zdeněk Bouček for his lifetime of devotion to Chalcidoidea.

TYPE MATERIAL. **USA: Virginia:** Essex Co.: 1mi. SE Dunnsville, 30.IV-13.V.1991, Malaise trap, D. R. Smith (Holotype, ♀, USNM). Paratype, 1♀: District of Columbia: NW Washington, Rock Creek Park, 19.ii.1984, W. E. Steiner; Ex dried frass in basal treehole of *Quercus alba* (USNM; left antenna slide mounted).

VARIATION. No noteworthy variation was detected. The specimen imaged has 8 scutellar setae.

HOST. Unknown.

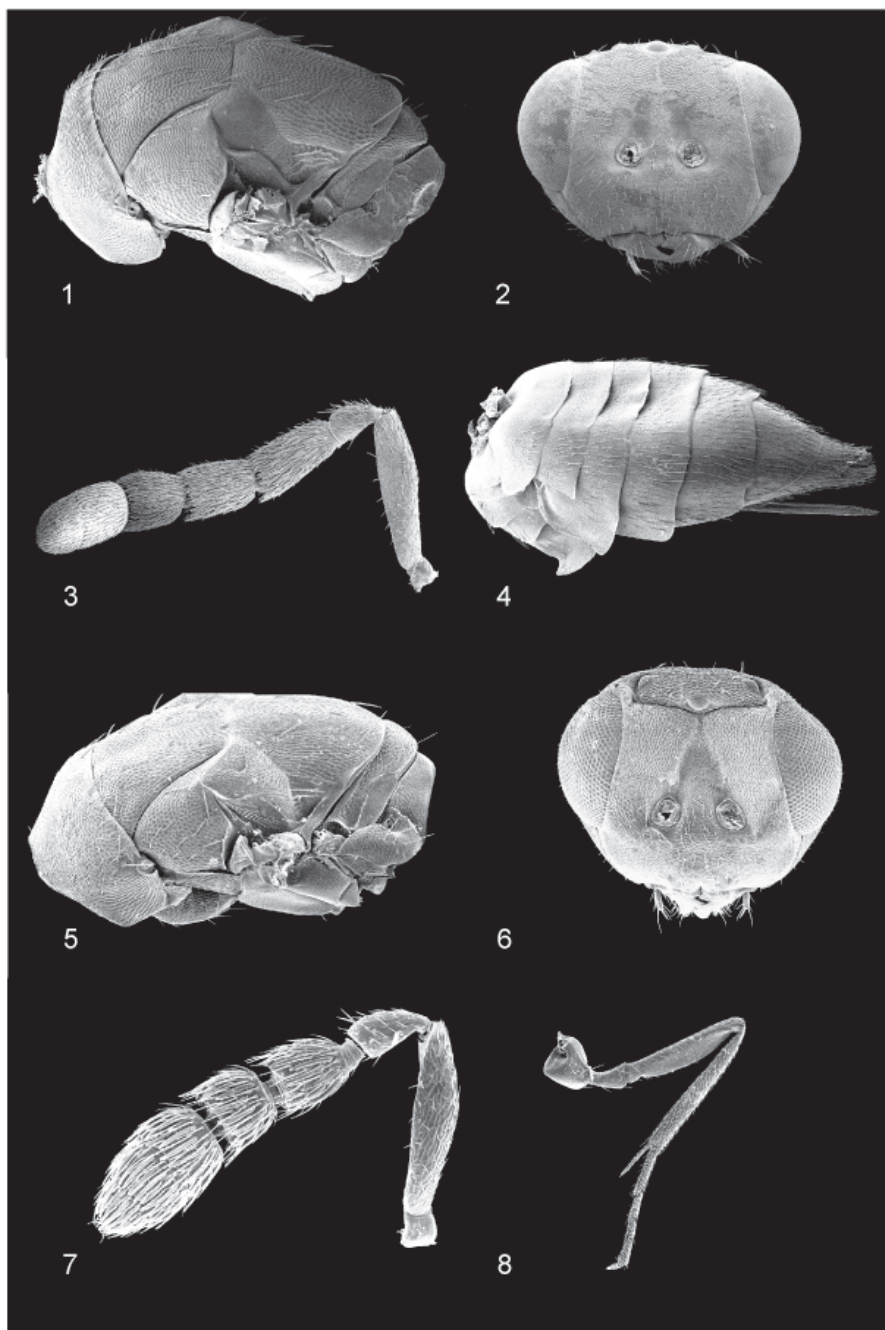
DISTRIBUTION. District of Columbia and Virginia.

Aulogymnus californica Gordh, 1977

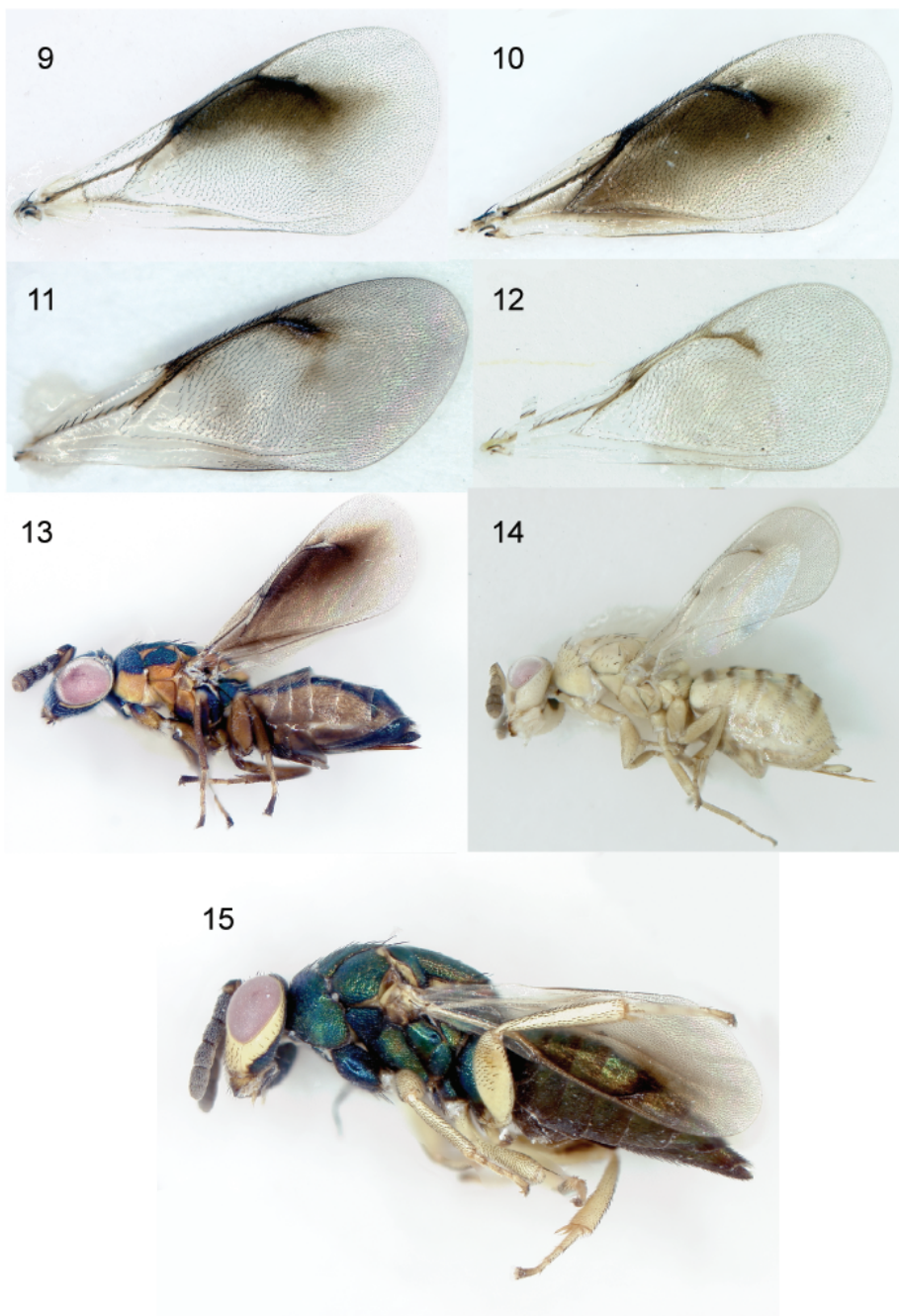
Aulogymnus californica Gordh, 1977: 207–208; holotype, ♀, by original designation (USNM Slide; 73743).

DIAGNOSIS. This species is most likely confused with *A. smithi* as both are primarily yellow with two funiculars. *Aulogymnus californica* generally has a gaster uniformly dark brown and *A. smithi* has dark banding along the tergal apices only, although some specimens may be suffused with brown ventrally. The uncus of *A. californica* is only 2.30X its length from the apex of the stigmatal vein whereas that of *A. smithi* is 3.50X its length. The occipital maculation extends laterally to the eye in *A. californica* and at most approaches the eye in *A. smithi* sp. nov.

DESCRIPTION OF FEMALE PARATYPE. Body length 2.30 mm. Color: yellow with the following areas brown: pedicel dorsoproximally, flagellomeres, medially interrupted transverse stripe between lower margins eyes, malar sulcus, triangular area encompassing occipital foramen and delimited by apex hypostomal bridge and dorsoposterior margin eyes, pronotum along anterior margin, axillular



Figs 1–8. *Aulogymnus bouceki*, sp. nov., 1–4: 1, mesosoma, lateral view; 2, head; 3, antenna; 4, gaster, lateral view. *A. smithi*, sp. nov., 5–8: 5, mesosoma, lateral view; 6, head; 7, antenna; 8, middle leg, anterior view.



Figs 9–15. *Aulogymnus io* (Girault), 9–10, forewings. *A. bouceki*, sp. nov., 11, 15: 11, forewing; 15, forewing. *A. smithi*, sp. nov., 12, 14: 12, forewing; 14, female habitus. *A. gorditus*, sp. nov., 13, forewing.

sulcus, acropleural sulcus, subalar region, mesopleural sulcus, mesepisternum medially, metapleuron, dorsellum laterally and medially, propodeum (with metallic green reflection subdorsally); wing veins brown with nebulous infuscation at parastigma and along length stigmal vein to middle wing disc, admarginal faintly infuscate. Sculpture: face finely imbricate-reticulate, scrobes polished. Mesosoma, propleuron, mesepisternum (anterior to femoral depression), coxae, and metasoma reticulate-imbricate; propodeum finely reticulate, this sculpture finest medially, with faint median carina in anterior half; prosternum pentagonal, transversely reticulate-imbricate with fine median channel; procoxa convex anteriorly, imbricate, with sparse, erect setae along anterolateral margin; mesepisternum reticulate, in ventral view with median line extending length, sparsely setose apically; scutellum lineolate and lacking shallow submedian lines, interstices inconspicuous; certain areas polished or polished with faint reticulation: dorsellum antieriad spiracle, Gt1; or with reticulation shallower than on dorsum of mesosoma: acropleuron, mesepimeron, metapleuron, and gaster. Head: 0.85× as high as broad (frons/vertex and eyes slightly collapsed), eye height 2.35× malar space; malar sulcus curved; scrobal depression shallow, scrobes uniting at mid-frons before intercepting median ocellus; transverse frontofacial suture very faintly indicated (concurrent with very fine transverse strip/collapse at level of midpoint of medial ocular margin); clypeal apex shallowly bilobate; ratio lateral ocellus:ocellocular distance:postocellar distance as 5:6:18. Antenna: scape reaching just above venter of midocellus; funiculars and club elongate, covered in MPS; ratio scape (minus radicle):pedicel:anellus:F1:F2:F3:club as 28:12:2:15:12:10:16; F1-F2 each slightly increasing in width along length. Mesosoma: pronotum and mesoscutum with evenly scattered subdecumbent setation, mesoscutum bare medially with stoutest setae near apical margin, scutellum with two pairs sublateral, stout, subdecumbent setae, one pair in anterior quarter and one pair in posterior quarter scutellum, oriented posteromedially; prepectus triangular, >2.0× size of tegula, surface sculpture similar to lateral pronotum; propodeal spiracle ovate and positioned ~1/2 its diameter from dorsellum, callus with 18 erect setae; mesotibia with robust seta apicoposteriorly, at least 2.00× longer than any seta on mesotibia; metacoxa 2.47× as long as broad, 0.67× as long as metafemur; metafemur 3.93× as long as broad; ratio marginal vein:postmarginal vein:stigmal vein as 35:23:22; basal setal line absent and cubital setal line terminating even with base MV; costal cell with row of 4 marginal setae antieriad parastigma, one longitudinal row of setae ventrally extend 4/5 length costal cell, uncus 2.30× its length from apex stigmal vein. Metasoma: elongate, ovate in dorsal view, truncate apically (due to retraction of Gt7+8 beneath Gt6 during drying) where ovipositor sheaths slightly extruded; gastral petiole visible as transverse, transparent strip in dorsal view, Gt2 - Gt7+8, ovipositor sheath (all measured dorsally): 30:10:13:17:18:26:??:7; cerci peg-like, roughly as long as broad.

Male [described from paratypes]. Length 1.22-1.50 mm. Similar to female except coloration and structure of antenna and gaster; with darker coloration on vertex and ocellar triangle, pronotum medially, mesoscutum, axilla laterally, scutellum laterally and broad stripe medially, dorsellum, metapleuron, mesopleuron medially, metacoxa, and propodeum completely dark; dark regions on the mesosoma mostly with metallic green reflection; scape reaching just above venter of midocellus; ratio scape (minus radicle):pedicel:A1:F1:F2:F3:club as 20:8:2:7:8:7:13; F1-F3 pedicellate, densely setose with setae extending beyond apex each flagellomere, clava symmetric and with spinose process apically. Metasoma: ovate in dorsal view, slightly tapered apically where adeagus slightly extruded; gastral petiole barely visible in dorsal view, Gt2 - Gt7+8, (all measured dorsally): 20[fusion event?]:7:5:11:8:7.

TYPE MATERIAL EXAMINED: [slide mounted]: **USA: California:** Felton, 1947, L. H. Weld, Ex *Callirhytis flora* [right label]; *Scotolinx californica* Gordh, *Quercus wislizenii*, Holotype, Type No. 73743 U.S.N.M. [red left label] (Holotype, ♀, USNM). [Slide mounted]: Allotype, 1♂, same data as holotype (USNM). Paratypes, 10♀ 5♂ : [Slide mounted]: **USA: California:** Whittier, 1947, on window in lab, H. Compere, Calif. # 224226 [right label], *Scotolinx californica* Gordh, Paratype, Type No. 73743 U.S.N.M. [red left label] (1♀ USNM); Whittier, 17.iv.1913,

Cynipid gall, Timb.#585a, P. H. Timberlake [right label], *Scotolinx californica* Gordh, Paratype, on *Quercus agrifolia*, det Gordh '75 [white left label] (1♀ 2♂ USNM); 5524°, gss, 9.ii.1893, Par. on cynipid on oak, Paratype No. 73743 U.S.N.M. [red label] (1♀ USNM); 5524°, gss[?], 9.ii.1893, Antenna mounted, Paratype No. 73743 U.S.N.M. [red label] (1TM USNM); 5524°, Les.[?], 29.iv.1893, Paratype No. 73743 U.S.N.M. [red label], [one male with small „♂ „, label and one with „Antenna mounted“ label] (3♀2♂ USNM); Felton, 1947, L. H. Weld, Ex *Callirhytis* flora on *Quercus wislizenii*, Paratype Type No. 73743 U.S.N.M. [red label], [1♂ point mounted separately, 2♀ co-mounted, 1♀ +1♂ co-mounted [x2]] (4♀ 3♂ USNM).

ADDITIONAL MATERIAL EXAMINED [slide mounted]. **USA: California:** Whittier, 17.iv.1913, Cynipid gall on *Quercus*, P. Timberlake [right label]; *Quercus agrifolia* stam. flr., Timb.# 585a, Type No. 73743 U.S.N.M. [red left label]; Solano Co.: Cold Canyon Rsr., 11km w. Winters, 30.iii.1991, S. L. Heydon (3♀ USNM); 5524°, gss[?], 9.ii.1893 (2♂ USNM); Felton, *Q. wislizenii* (co-mounted ♀♂ USNM); Felton, *Q. wislizenii*, ex gall of *Callirhytis flora* Weld (co-mounted ♀♂ USNM).

VARIATION. In both sexes the wing infuscation ranges from nearly hyaline to having infuscation around the parastigma, stigma, and anteroapical margin; sometimes only the stigmal vein has an infusate cloud posterad. Some female specimens have the mesosoma immaculate while others possess maculation on the scutellum. The gaster may be either entirely brownish to nearly entirely yellow with brown dorsally trending to transverse brown stripes along gastral terga. The propodeum can either be primarily yellow or having brown maculation as follows: propodeum brown except medially/submedially and posterolaterally or brown narrowly along anterior margin. One specimen has the propodeum nearly completely brown. Males can have the brown coloration reduced: a medial strip on the pronotum, spot laterally on the lateral lobe mesoscutum, mesoscutum except for anterolateral corners; or absent: metacoxa and mesopleuron solid yellow.

HOST. Reared from *Callirhytis* flora on *Quercus wislizenii*. This species is also associated with *Q. agrifolia* and the staminate flowers thereon.

DISTRIBUTION. USA (CA).

Aulogymnus flavimaculata (Girault, 1916)

Pseudolynx flavimaculata Girault, 1916b: 153–154; lectotype, ♀, here designated.

Pseudolynx flavimaculatus: Peck 1951: 456; name change.

Pseudolynx flavimaculatus: Schauff & LaSalle 1993: 492.

DIAGNOSIS. This species is similar in color to *Aulogymnus gorditus* sp. nov. and *A. io*, but differs in having the clava 2.31× as long as broad, gaster 4.00× as long as broad, dorsellum 2.00× as long as propodeum medially and with 8 scutellar setae; *A. gorditus* sp. nov. has the clava only 1.21× as long as broad, gaster 1.49× as long as broad, dorsellum 2.00× as long as propodeum medially and with 4 scutellar setae; whereas *A. io* has the clava 1.93× as long as broad, gaster 1.53× as long as broad, dorsellum 1.27× as long as propodeum medially and usually with 8 scutellar setae.

DESCRIPTION OF FEMALE HOLOTYPE. Body length 4.10 mm. Color: metallic blue-green (purple reflections on mesepimeron, metapleuron, callus, metacoxa) except following either orange: scape; circumocular strip, interconnected both dorsally by strip extending posterad lateral ocelli, narrower strip diverging from former dorsal strip at dorsal eye margin and extending anterad anterior ocellus, and anteriorly by transverse strip at level of midpoint of medial ocular margin (latter two interconnected medially along scrobal depression) and expanded medially as diamond shape dorsad toruli, ventral margin of toruli connected to circumocular strip by transverse strip that is continuous with circumoral strip; tegula; lateral panel pronotum; narrow triangular strip along anterolateral margin mesoscutum at notaulus; parapsidal lobe laterally, mesally and narrowly along posterior margin; axilla laterally, mesally and narrowly along posterior margin; scutellum along lateral and posterior margins; dorsellum in submedial three-quarters; prepectus; mesopleuron in dorsal third; axillula;

gaster laterally; or brown: pedicel dorsally, flagellum; gaster dorsally and ventrally (with faint metallic reflections); wing veins and infuscation posterad marginal vein between parastigma and stigmal vein, slight infuscation along basal and cubital setal lines. Sculpture: face reticulate, mesosoma, mesepisternum (anterior to femoral depression), metapleuron, coxae, propodeum and metasoma reticulate, interstices smooth and rounded; scutellum lacking shallow submedian lines; certain areas polished or polished with faint reticulation: dorsellum anterior spiracle, Gt₁; or with reticulation shallower than on dorsum of mesosoma: acropleuron, mesepimeron, and gaster. Head: 0.75× as high as broad, eye height 2.00× malar space; malar sulcus curved; scrobal depression shallow, scrobes uniting at mid-frons before intercepting median ocellus as narrow groove, transverse frontofacial suture faintly indicated, concurrent with transverse strip at level of midpoint of medial ocular margin; clypeal apex shallowly bilobate; ratio lateral ocellus:ocelloocular distance:postocellar distance as 6:9:21. Antenna: [antennae slide mounted]; funiculars and club stout, densely covered in MPS; ratio scape (minus radicle):pedicel:anellus: F1:F2:club as 35:15:4:21:15:30; F1 and F2 slightly narrowed basally. Mesosoma: [propleuron and prosternum partially obscured by head] propleuron subrectangular, reticulate-imbricate; prosternum pentagonal, transversely reticulate-imbricate with fine median carina; procoxa convex anteriorly, imbricate, with sparse, erect setae along anterolateral margin; mesepisternum reticulate, in ventral view with median line extending length, sparsely setose apically; pronotum and mesoscutum with evenly scattered decumbent setation, scutellum with two sublateral rows of 4 subdecumbent setae, oriented postermedially; prepectus triangular, ≥2.0× size of tegula, surface sculpture similar to lateral pronotum; propodeum reticulate, this sculpture finest medially, spiracle ovate and positioned ~1/4 its diameter from dorsellum, callus with ~15 erect setae; mesotibia with robust seta apicoposteriorly, at least 2.00× longer than any seta on mesotibia; metacoxa 4.40× as long as broad, 0.59× as long as metafemur; metafemur 5.44× as long as broad; ratio marginal vein:postmarginal vein:stigmal vein as 60:40:41; basal and cubital setal lines complete; costal cell with row of 12 marginal setae anterior parastigma, two longitudinal rows of setae ventrally extend length costal cell, uncus 3.00× its length from apex stigmal vein. Metasoma: gaster [dorsally collapsed] elongate in dorsal view, pointed apically where ovipositor sheaths slightly extruded; gastral petiole visible as transverse strip in dorsal view, Gt₂ - Gt₇₊₈, ovipositor sheath (all measured dorsally): 35:30:35:30:45:50:35:18; cerci peg-like, ~2.0× as long as broad.

Male. Unknown.

TYPE MATERIAL EXAMINED. **USA: Minnesota:** Ramsay Co.: Type No. 19631 U.S.N.M.; *Pseudolynx flavimaculata* Girault ♀ type [handwritten]; [Slide of antennae]; 2 legs: *Pseudolynx flavimaculata* Girault ♀ type [handwritten]; 19631 [irregular red label] (Lectotype ♀ USNM).

VARIATION. Not applicable.

HOST. Unknown.

DISTRIBUTION. Minnesota (USA).

Aulogymnus flavitibiae (Girault, 1916)

Microlynx flavitibiae Girault, 1916a: 131-132; lectotype, ♀, here designated.

Aulogymnus flavitibiae: Schauff & LaSalle 1993: 492.

DIAGNOSIS. This species has faint submedian lines on the rounded scutellum and citrine extreme apices femora, tibiae, and tarsi. It is similar to *A. bouceki* sp. nov. in that there are 3 funiculars, but those of robust with denser MPS (Fig. 3); *A. smithi* sp. nov. and *A. californica* only have two funiculars. Although both *A. bouceki* sp. nov., *A. smithi* sp. nov. and *A. californica* have has yellow

extremities, there is no dark, distinct infuscation on the femora of these species. *Aulogymnus californica* and *A. smithi* sp. nov. range from dusky to citrine. The submedian lines of *A. bouceki* sp. nov. are faintly indicated by slight differences in color and sculpture, and are apparently absent in *A. californica* and *A. smithi* sp. nov.; all three of these latter species have the scutellum flat, not rounded dorsally.

DESCRIPTION OF FEMALE LECTOTYPE. Body length 2.71 mm. Color: dark brown with metallic green-blue reflections except following either yellow: scape (remaining antenna yellow-brown), all tibiae and tarsi, excluding apex pretarsomeres brownish [head of HT smashed on slide; following orange/yellow: thin circumocular strip, interconnected both dorsally by strip extending posterad lateral ocelli and anteriorly by transverse strip (discontinuous at scrobal depression) at level of midpoint of medial ocular margin, scrobal depression from midpoint to median ocellus]; or brown: tegula, wing veins and infuscation posterad parastigma and stigmal vein. Sculpture: [face reticulate, scrobes polished]. Mesosoma, mesepisternum (anterior to femoral depression), metapleuron, coxae, propodeum and metasoma reticulate-imbricate with scutellum tending toward lineolate and having shallow submedian lines, interstices inconspicuous; certain areas polished or polished with faint reticulation: dorsellum anterior spiracle, Gt₁; or with reticulation shallower than on dorsum of mesosoma: acropleuron, mesepimeron, and gaster. Head: [0.78× as high as broad, eye height 1.61× malar space; malar sulcus curved; scrobal depression shallow, scrobes uniting at midfrons before intercepting median ocellus; transverse frontofacial suture faintly indicated (concurrent with transverse strip at level of midpoint of medial ocular margin); clypeal apex shallowly bilobate; ratio lateral ocellus: ocellocular distance: postocellar distance as 8:10:26. Antenna: [scape reaching just above venter of midocellus]; funiculars and club stout, densely covered in MPS; ratio scape (minus radicle): pedicel: anellus: F1:F2:F3: club as 31:10:3:12:11:10:23; F1-F3 each subequal in width along length. Mesosoma: propleuron subrectangular, reticulate-imbricate; prosternum pentagonal, transversely reticulate-imbricate with fine median carina; procoxa convex anteriorly, imbricate, with sparse, erect setae along anterolateral margin; mesepisternum reticulate, in ventral view with median line extending length, sparsely setose apically]; pronotum and mesoscutum with evenly scattered subdecumbent setation, scutellum with two sublateral rows each of 3 subdecumbent setae, 2 in anterior third and one in posterior third scutellum, oriented posteromedially; prepectus triangular, ≥2.0× size of tegula, surface sculpture similar to lateral pronotum; propodeum finely reticulate, this sculpture finest medially, with fine median carina, spiracle ovate and positioned ~1/4 its diameter from dorsellum, callus with 9-10 erect setae; mesotibia with robust seta apicoposteriorly, at least 2.00× longer than any seta on mesotibia; metacoxa 1.94× as long as broad, 0.81× as long as metafemur; metafemur 3.23× as long as broad; ratio marginal vein: postmarginal vein: stigmal vein as 54:33:35; basal and cubital setal lines complete; costal cell with row of 6 marginal setae anterior parastigma, two longitudinal rows of setae ventrally extend length costal cell, uncus 3.00× its length from apex stigmal vein. Metasoma: elongate, tear-drop shape in dorsal view, pointed apically where ovipositor sheaths slightly extruded; gastral petiole visible as transverse strip in dorsal view, Gt₂ - Gt₇₊₈, ovipositor sheath (measured dorsally): 35:18:15:15:18:25:12:8; cerci peg-like, roughly as long as broad.

Male. Unknown.

TYPE MATERIAL. USA: California: Santa Cruz Co.: Santa Cruz Mts; Type No. 19648 USNM.; [Slide mounted: antennae, wing, head]: *Microlynx flavitibiae* Girault type, Type No. 19648 U.S.N.M. [handwritten red label, wing from a paralectotype as lectotype has two wings] (Lectotype ♀ USNM). Paralectotypes, 3♀, same data as lectotype (USNM).

MATERIAL EXAMINED. USA: California: San Diego Co.: Cleveland NF, Fry Creek Campground, 15.xi.1988, L. Fry, ex gall on *Quercus* (1♀ USNM).

VARIATION. The yellow areas on the legs can range from citrine to a dusky yellow. Metallic coloration on head and body ranges from dark black-green to a brighter green-blue.

HOST. Known from an undetermined cynipid gall on staminate flowers on *Quercus agrifolia* Nee. Weld (1957) reported *Callirhytis congregata* (Ashmead, 1896) galling the staminate flowers in the fall in Oakland, CA. *Callirhytis flora* (Weld, 1922), a midrib and petiole galler, on *Quercus wislizenii* A.DC is also a recorded host.

DISTRIBUTION. California (USA).

DISCUSSION. Apparently, the wings from „the female“ (presumably the type specimen) that Girault slide mounted actually originated from one of the paratypes as the holotype retains a full complement of wings.

***Aulogymnus gorditus* sp. nov.**

(Fig. 13)

DIAGNOSIS. This species is similar in color to *Aulogymnus flavimaculata* and *A. io*, but differs with the clava only 1.21× as long as broad, gaster 1.49× as long as broad, dorsellum 2.00× as long as propodeum medially and with 4 scutellar setae. *Aulogymnus flavimaculata* has the clava 2.31× as long as broad, gaster 4.00× as long as broad, dorsellum 2.00× as long as propodeum medially and with 8 scutellar setae; whereas *A. io* has the clava 1.93× as long as broad, gaster 1.53× as long as broad, dorsellum 1.27× as long as propodeum medially and usually with 8 scutellar setae.

DESCRIPTION OF FEMALE HOLOTYPE. Body length 2.70 mm. Color: metallic blue-green except following either orange: scape and pedicel ventrally; lateral panel pronotum; tegula; narrow triangular strip along anterolateral margin mesoscutum at notaulus; parapsidal lobe laterally, mesally and narrowly along posterior margin; axilla laterally, mesally and narrowly along posterior margin; scutellum along lateral and posterior margins; prepectus; mesopleuron in dorsal half and along femoral depression, extending ventrally to midline of mesopleuron; axillula; metapleuron in anterior half; dorsellum except laterally anterad spiracle; metacoxa in apical 4/5; or orange-brown: legs with exception lateroproximal procoxa and ventral mesofemur metallic greenish; or whitish: circumocular strip, interconnected both dorsally by strip extending posterad lateral ocelli and anteriorly by transverse strip at level of midpoint of medial ocular margin, ventral margin of toruli connected to circumocular strip by transverse strip; or brown: scape and pedicel dorsally (faint metallic reflections); gaster (darker and with metallic reflections, along dorsolateral margin and Gt₆₋₇₊₈), wing veins and extensive infuscation posterad marginal vein between parastigma and stigmal vein, along basal and cubital setal lines (Fig. 13). Sculpture: face reticulate. Mesosoma, mesepisternum (anterior to femoral depression), metapleuron, coxae, propodeum and metasoma reticulate, interstices smooth and rounded; scutellum lacking shallow submedian lines; certain areas polished or polished with faint reticulation: dorsellum anteriad spiracle, Gt₁; or with reticulation shallower than on dorsum of mesosoma: acropleuron, mesepimeron, and gaster. Head: 0.68× as high as broad, eye height 1.90× malar space; malar sulcus curved; scrobal depression shallow, scrobes uniting at midfrons before intercepting median ocellus, transverse frontofacial suture faintly indicated, concurrent with transverse strip at level of midpoint of medial ocular margin; clypeal apex shallowly bilobate; ratio lateral ocellus:ocellocular distance:postocellar distance as 5:7:22. Antenna: scape reaching just above venter of midocellus; funiculars and club stout, densely covered in MPS; ratio scape (minus radicle):pedicel:anellus: F1:F2:club as 27:10:2:14:10:17; F1 narrowed basally, F2 subquadrate, clava nearly circular in lateral view (Fig. 13). Mesosoma: propleuron subrectangular, reticulate-imbricate; prosternum pentagonal, transversely reticulate-imbricate with fine median

carina; procoxa convex anteriorly, imbricate, with sparse, erect setae along anterolateral margin and anterior face; mesepisternum reticulate, in ventral view with median line extending length, a setose apically; pronotum and mesoscutum with evenly scattered decumbent setation, scutellum with two sublateral rows of 2 subdecumbent setae, oriented posteromedially; prepectus triangular, $\geq 2.0\times$ size of tegula, surface sculpture similar to lateral pronotum; propodeum reticulate, this sculpture finest medially, spiracle ovate and positioned adjacent to dorsellum, callus with 15 erect setae; mesotibia with robust seta apicoposteriorly, at least $2.00\times$ longer than any seta on mesotibia; metacoxa $2.00\times$ as long as broad, $0.73\times$ as long as metafemur; metafemur $3.67\times$ as long as broad; ratio marginal vein:postmarginal vein:stigmatal vein as 40:25:24; basal and cubital setal lines complete; costal cell with row of ~ 16 marginal setae antierad parastigma, two irregular longitudinal rows of setae ventrally extend length costal cell, uncus $5.10\times$ its length from apex stigmatal vein. Metasoma: ovate in dorsal view, pointed apically where ovipositor sheaths slightly extruded; gastral petiole visible as transverse strip in dorsal view, Gt₂ - Gt₇₊₈, ovipositor sheath (all measured dorsally): 10:10:15:23:22:25:7:7; cerci peg-like, $\sim 2.0\times$ as long as broad.

ETYMOLOGY. From the diminutive form of the Spanish word *gordo*, meaning “fat”.

Male. Unknown.

TYPE MATERIAL. **USA: Virginia:** Essex Co.: 1mi. SE Dunnsville, 37°52' N 76°48' W, 4-22.IV.1996, MT, D. R. Smith (Holotype, ♀, USNM). Paratype, ♀, same data as holotype: **Louisa Co.:** 4mi. S. Cuckoo, 16.iii-4.iv.1989, J. Kloke & D. Smith, Malaise trap (1 ♀, USNM).

VARIATION. Not applicable.

HOST. Unknown.

DISTRIBUTION. Virginia (USA).

Aulogymnus io (Girault, 1916) comb. nov.

(Figs 9, 10)

Pseudolynx io Girault, 1916b; lectotype, ♀, here designated.

Aulogymnus io: Schauff & LaSalle 1993: 492.

Pseudolynx marilandia Girault, 1917; lectotype, ♀, here designated; **syn. nov.**

Pseudolynx marylandia Peck, 1951; unjustified emendation of *Pseudolynx marilandia* Girault, 1917.

Aulogymnus marilandia: Schauff & LaSalle, 1993: 492.

DIAGNOSIS. This species is similar in coloration to *Aulogymnus flavimaculata* and *A. gorditus* n. sp., but differs with the clava $1.93\times$ as long as broad, gaster $1.53\times$ as long as broad, dorsellum $1.27\times$ as long as propodeum medially and usually with 8 scutellar setae. *Aulogymnus flavimaculata* has the clava $2.31\times$ as long as broad, gaster $4.00\times$ as long as broad, dorsellum $2.00\times$ as long as propodeum medially and with 8 scutellar setae; whereas *A. gorditus* has the clava only $1.21\times$ as long as broad, gaster $1.49\times$ as long as broad, dorsellum $2.00\times$ as long as propodeum medially and with 4 scutellar setae.

DESCRIPTION OF FEMALE LECTOTYPE. Body length 3.20 mm (mesosoma+gaster only; head smashed on slide). Color: metallic blue-green (stronger green on lateral surfaces, dorsum duller bronze-green) except following either orange: [head of HT smashed on slide; following orange: circumocular strip, interconnected both dorsally by strip extending posterad lateral ocelli and anteriorly by transverse strip at level of midpoint of medial ocular margin, ventral margin of toruli connected to circumocular strip by transverse strip] tegula; narrow triangular strip along anterolateral margin mesoscutum at notaulus; parapsidal lobe laterally, mesally and narrowly along posterior margin; axilla laterally, mesally and narrowly along posterior margin; scutellum along lateral and posterior

margins; prepectus except for spot near anterodorsal margin; mesopleuron in dorsal third and along femoral depression, extending ventrally to midline of mesopleuron; axillula; dorsellum in submedial half; or orange-brown: trochanters and legs; or dark brown: gaster (with faint metallic reflections, particularly in anterior quarter), wing veins and infuscation posterad marginal vein between parastigma and stigmal vein, slight infuscation along basal and cubital setal lines. Sculpture: face indiscernible [holotype head smashed on slide]. Mesosoma, mesepisternum (anterior to femoral depression), metapleuron, coxae, propodeum and metasoma reticulate, interstices smooth and rounded; scutellum lacking shallow submedian lines; certain areas polished or polished with faint reticulation: dorsellum anterior spiracle, Gt₁; or with reticulation shallower than on dorsum of mesosoma: acropleuron, mesepimeron, and gaster. Head: [0.71× as high as broad, eye height 2.39× malar space; malar sulcus curved; scrobal depression shallow, scrobes uniting at mid-frons before intercepting median ocellus, transverse frontofacial suture faintly indicated (concurrent with transverse strip at level of midpoint of medial ocular margin); clypeal apex shallowly bilobate; ratio lateral ocellus:ocellocular distance:postocellar distance as 8:10:26. Antenna: scape reaching just above venter of midocellus]; funiculars and club stout, densely covered in MPS; ratio scape (minus radicle):pedicel:anellus: F1:F2:club as 36:13:3:22:15:26 [club slightly collapsed laterally]; F1 and F2 slightly narrowed basally. Mesosoma: [propleuron subrectangular, reticulate-imbricate; prosternum pentagonal, transversely reticulate-imbricate with fine median carina]; procoxa convex anteriorly, imbricate, with sparse, erect setae along anterolateral margin; mesepisternum reticulate, in ventral view with median line extending length, sparsely setose apically]; pronotum and mesoscutum with evenly scattered decumbent setation, scutellum with two sublateral rows of 4 subdecumbent setae [see Variation section], oriented posteromedially; prepectus triangular, ≥2.0× size of tegula, surface sculpture similar to lateral pronotum; propodeum reticulate, this sculpture finest medially, spiracle ovate and positioned ~1/4 its diameter from dorsellum, callus with 13 erect setae; mesotibia with robust seta apicoposteriorly, at least 2.00× longer than any seta on mesotibia; metacoxa 2.22× as long as broad, 0.59× as long as metafemur; metafemur 3.33× as long as broad; ratio marginal vein:postmarginal vein:stigmal vein as 62:35:33; basal and cubital setal lines complete; costal cell with row of 9 marginal setae anterior parastigma, two longitudinal rows of setae ventrally extend length costal cell, uncus 3.33× its length from apex stigmal vein. Metasoma: ovate in dorsal view, pointed apically where ovipositor sheaths slightly extruded; gastral petiole visible as transverse strip in dorsal view, Gt₂ - Gt₇₊₈, ovipositor sheath (all measured dorsally): 25:10:17:18:17:47:15:14; cerci peg-like, ~2.0× as long as broad.

Male. Unknown.

TYPE MATERIAL EXAMINED. **USA: Massachusetts:** Essex Co.: North Saugus, 5-24-07; JC Crawford collector; Type No. 19630 U.S.N.M.; *Pseudolynx* [*flavitibia* crossed out] *io* ♀ type [handwritten]; [Slide mounted: antennae, wing, parts of two legs, head]: *Pseudolynx* [*flavitibia* crossed out] *io* Girault ♀ type [handwritten white label]; 19648 [Irregular red label] (Lectotype ♀ USNM).

ADDITIONAL MATERIAL EXAMINED. **Illinois:** Piatt: White Heath, 25.iv.1939, J. C. Dirks, shrub #3 (1♀ USNM); **Maryland:** Montgomery: Plummers Island, 14.iv.08, H. S. Barber (1♀ USNM); **Minnesota:** Olmsted: C. N. Ainsdale (1♀ USNM); **South Carolina:** Pickens: Clemson, Fant's Grove, 13.iv.1951, W. F. Chamberlain, alfalfa field, 172 (1♀ USNM); **Virginia:** City of Falls Church: Reared 12.iv.1916 from *Quercus palustris*, Middleton Wm, 12050 Hopkins US (2♀ USNM); Reared 28.iv.1914 from *Quercus*, W. Middleton, 12029 Hopkins US (1♀ USNM); 18.iv.1918, Middleton Wm, (1♀ USNM); Essex: 1 mi. SE Dunnsville, 37° 52'N 76° 48'W, 4-22.iii.1995, D. Smith, MT (2♀ USNM); Fairfax: Vienna, 17.iv.1913, R. A. Cushman (1♀ USNM); **West Virginia:** Monongalia: Morgantown, 10.v.1983, L. Butler, Cacapon Batt. P.A., #143 (1♀ USNM).

VARIATION. Females vary in length from about 2.50-3.50 mm. In females, the orange areas vary in width and extent especially around the edges of mesosomal regions (scutellum, lateral lobe mesoscutum, dorsellum, etc.). The coloration on the legs, particularly the femur, can range from an

orange to having darker infuscation with metallic reflections. The scutellum usually has 4 or 6 setae and 5-9 marginal costal setae apically with 1 or 2 rows ventral setae ventrally on costal cell. The coxae can range from orange apically to almost entirely metallic. The infuscation on the forewing is more or less extensive along the anterior margin (Figs. 9, 10). Comparison of the lectotypes of *A. io* and *A. marilandia* indicate no differences substantial enough to warrant specific status. F1 is slightly shorter in *A. marilandia* than in *A. io*, but the two specimens are otherwise very similar in coloration, size, setation and sculpture. The lateral protibia and lateral prepectus metallic blue in *A. marilandia* are purported differences from *A. io*, however, the latter specimen has the protibia faintly suffused with metallic blue and the lateral prepectus with a blue spot dorsally. What we currently conceive of as *Aulogymnus io* may contain cryptic species that could be better discerned via morphometric analysis coupled with focused rearings of both sexes from a given host.

HOST. The Hopkins numbers from the City of Falls Church records above indicate the hosts include Cynipidae on *Quercus*. Hopkins 12029 notes indicate this specimen was attempting to oviposit into a marked bud on *Quercus alba* L. Although several cynipid genera are known to gall buds (*Acraspis* Mayr 1881, *Neuroterus* Hartig 1840, *Andricus* Hartig 1840, *Callirhytis* Förster 1869, and *Liodora* Förster 1869), only *Callirhytis* (as *Andricus*) *seminator* (Harris 1841) (Cynipidae), the wool sower, is mentioned in the notes. However, this gall is usually observed in May after ovipositional activity by the galler during bud break. It is unknown how early in the development of a cynipid gall that *Aulogymnus* spp. attack. Hopkins 12050 indicates two live *Aulogymnus* were removed from galls of *Amphibolips* (Reinhard 1865) on *Quercus coccinea* Muenchh. According to Weld (1959), six species of *Amphibolips* attack scarlet oak, galling acorns (*A. prunus* Cresson), buds (*A. tinctoriae* Ashmead 1896, *A. near cookii* Gillette 1888), and leaves (*A. nubilipennis* (Harris 1841), *A. confluenta* (Harris 1841), *A. quercuscoelebs* (Osten Sacken 1861)).

DISTRIBUTION. Massachusetts, Minnesota, West Virginia, Virginia (USA).

Aulogymnus minyas (Walker, 1847)

Eulophus minyas Walker, 1846: 143; nomen nudum by Peck (1951: 594).

Eulophus minyas Walker, 1847: 26; lectotype, ♀, designated by Burks (1975: 146)

Aulogymnus minyas: Burks 1975: 146.

DIAGNOSIS. Among species of *Aulogymnus*, this species is uncommon in that it possesses an apically carinate scutellum that overhangs the dorsellum and, though likely less reliable, a coppery-green coloration.

DESCRIPTION OF FEMALE LECTOTYPE. Body length 2.80 mm. Color: dark brown with metallic yellow-green reflections, cupreous reflections dorsally, except following either golden: scape (remaining antenna brown), apices femora, all tibiae and tarsi, excluding apex pretarsomeres brownish; or brown: tegula, femora [some metallic reflections], wing veins and faint infuscation posterad marginal and stigmal vein, gaster. Sculpture: face and scrobes reticulate. Mesosoma, mesepisternum (anterior to femoral depression), metapleuron, coxae, propodeum and metasoma reticulate-imbricate with scutellum tending toward lineolate laterally and lacking shallow submedian lines, interstices conspicuous; certain areas polished or polished with faint reticulation: dorsellum anteriorad spiracle, Gt1; or with reticulation shallower than on dorsum of mesosoma: acropleuron, mesepimeron, and gaster. Head: 0.78× as high as broad, eye [collapsed] height 2.50× malar space; malar sulcus curved; scrobal depression shallow, scrobes uniting at mid-frons before intercepting median ocellus; transverse frontofacial suture faintly indicated (concurrent with coppery transverse strip at

level of midpoint of medial ocular margin); clypeal apex shallowly bilobate; ratio lateral ocellus:ocellocular distance:postocellar distance as 7:6:18. Antenna: scape reaching just below midocellus; [flagella collapsed] funiculars and club stout, covered in 2-3 rows staggered MPS; ratio scape (minus radicle):pedicel:anellus: F1:F2:club as 30:12:2:18:10:23; F1-F2 each subequal in width along length. Mesosoma: [propleuron and prosternum obscured by head]; procoxa convex anteriorly, imbricate, with sparse, erect setae along anterolateral margin; mesepisternum reticulate-imbricate, in ventral view with median line extending length, asetose apically; pronotum and mesoscutum with evenly scattered subdecumbent setation, scutellum with two sublateral rows each of 2 subdecumbent setae, one in anterior third and one in posterior third scutellum [abraded], apex carinate, overhanging dorsellum; prepectus triangular, $\geq 2.0\times$ size of tegula, surface sculpture similar to lateral pronotum; propodeum finely reticulate, this sculpture finest medially, with fine median carina, spiracle ovate and positioned $\sim 1/4$ its diameter from dorsellum, callus with 2 erect setae; mesotibia with robust seta apicoposteriorly, at least $2.00\times$ longer than any seta on mesotibia; metacoxa $2.60\times$ as long as broad, $0.78\times$ as long as metafemur; metafemur $4.00\times$ as long as broad; ratio marginal vein:postmarginal vein:stigmatal vein as 45:30:28; basal and cubital setal lines complete; costal cell in apical half with row of 11 marginal setae antierad parastigma, single longitudinal row of setae ventrally extend length costal cell, uncus $3.67\times$ its length from apex stigmatal vein. Metasoma: [badly collapsed laterally] elongate, pointed apically where ovipositor sheaths slightly extruded; gastral petiole visible as transverse strip in dorsal view, [accurate measurements not possible due to extensive collapse]; cerci peg-like, roughly as long as broad. Male. Unknown.

TYPE MATERIAL EXAMINED. Lectotype [circular label with purple edging]; ♀ *Eulophus minyas* Walk., Des. as LT by Burks, put in *Aulogymnus*; ♀ gen. nr. *Olynx*, det. Z. Bouček 1974; B.M. Type Hym. 5.2277. [No locality label on lectotype; Walker (1846: 143) indicates that this species was collected at St. John's Bluff, Florida] (Lectotype ♀, BMNH).

VARIATION. Not applicable.

HOST. Unknown.

DISTRIBUTION. Florida (USA).

DISCUSSION. This species is similar to an unassociated male from the Wichita Mountains National Wildlife Refuge, OK. Aside from secondary sexual characteristics and some coloration differences (infusate tibiae, pale band across vertex), the two specimens are alike in general habitus and both have the carinate, overhanging scutellum. It is mentioned in the event that the alternate sex of either specimen is reliably determined at some point.

Aulogymnus purpurescens sp. nov.

DIAGNOSIS. This species is the only one to possess primarily metallic purple reflections, a smooth metacoxa with very fine lineolate sculpture and callus with sparse setation (<10 setae). Those species having reduced metacoxal sculpture (e.g., *A. smithi* sp. nov.) never have metallic purple reflections.

DESCRIPTION OF FEMALE HOLOTYPE. Body length 2.05 mm. Color: brown with metallic purple to bluish (head, mesosoma, coxae, femora, less distinctly: gaster) reflections; or pale brown as follows: circumocular strip in dorsal half eye, interconnected as follows: dorsally both by strip extending posterad lateral ocelli and by strip extending antierad median ocellus; transverse strip at level of midpoint of medial ocular margin, this strip angling dorsad along scrobes before uniting into thin line that intercepts strip extending antierad median ocellus; wing veins pale brown basally becom-

ing yellow apically, hyaline. Sculpture: face finely imbricate-reticulate ventrally becoming slightly coarser dorsally, scrobes similarly sculptured, genae becoming lineolate. Pronotum finely, transversely imbricate; mesoscutum, prepectus reticulate; mesopleuron smoother, finely imbricate-reticulate; propodeum finely reticulate with some rugulosity along anterior margin, reticulation finest medially, without median carina; prosternum pentagonal, imbricate with fine median channel; procoxa convex anteriorly, imbricate, with a few sparse, subdecumbent setae along anterior surface; mesepisternum glabrous, in ventral view with median line extending length, sparsely setose apically; scutellum lineolate and lacking shallow submedian lines, interstices conspicuous; certain areas polished or polished with faint reticulation: dorsellum antieriad spiracle, Gt₁; or with reticulation shallower than on dorsum of mesosoma: acropleuron, mesepimeron, metapleuron, and gaster. Head: 0.80× as high as broad, eye height 1.67× malar space; malar sulcus curved; scrobal depression shallow, scrobes uniting at mid-frons before intercepting median ocellus; transverse frontofacial suture present; clypeal apex shallowly bilobate; ratio lateral ocellus:ocelloocular distance:postocellar distance as 3:5:20. Antenna: scape reaching just above venter of midocellus; funiculars and club robust, densely covered in MPS; ratio scape (minus radicle):pedicel:A1:F1:F2:club as 22:8:2:8:7:18; F1-F2 each subequal in width along length, clava symmetric apically. Mesosoma: pronotum and mesoscutum with sparsely scattered subdecumbent setation, mesoscutum bare medially and two rows of 4 setae subdorsally with stoutest setae near apical margin, scutellum with two pairs sublateral, stout, subdecumbent setae, one pair in anterior third and one pair near apex, all oriented posteromedially; prepectus triangular, >2.0× size of tegula, surface sculpture similar to lateral pronotum; propodeal spiracle ovate and positioned <1/2 its diameter from dorsellum, median carina absent; callus with 6 erect setae; mesotibia with robust seta apicoposteriorly, at least 2.00× longer than any seta on mesotibia; metacoxa 3.00× as long as broad, 0.75× as long as metafemur; metafemur 5.71× as long as broad; ratio marginal vein:postmarginal vein:stigmatal vein as 25:13:17; basal setal line present and cubital setal line terminating at apex basal setal line; costal cell with row of 6 marginal setae antieriad parastigma, one longitudinal row of setae ventrally extend apical 4/5 length costal cell, uncus 2.50× its length from apex stigmatal vein. Metasoma: elongate, ovate in dorsal view, tapered apically where ovipositor sheaths slightly extruded; gastral petiole visible as transverse, transparent strip in dorsal view, Gt₂ - Gt₇₊₈, ovipositor sheath (all measured dorsally): 12:10:15:15:17:18:9:8; cerci peg-like, roughly as long as broad.

Male. Length 1.65-1.73 mm. Similar to female except in the structure of the antenna and gaster as follows: scape reaching just above venter of midocellus; ratio scape (minus radicle):pedicel:A1:A2:F1:F2:F3:club as 21:7:1:1:8:8:16; F1-F3 pedicellate, densely setose with setae extending well beyond apex each flagellomere, clava symmetric and with spinose process apically. Metasoma: ovate in dorsal view, slightly tapered apically where adeagus slightly exerted; gastral petiole barely visible in dorsal view, Gt₂ - Gt₇₊₈, (all measured dorsally): 10:12:11:11:12:10:5.

ETYMOLOGY. Derived from the Latin stem *purpura*, meaning purple.

TYPE MATERIAL EXAMINED. **USA: Virginia:** Essex Co.: 1mi. SE Dunnsville, 23.III-11.IV.1995, Malaise trap, D. R. Smith (Holotype, ♀, USNM). Paratypes, 2♂, same data as holotype (USNM).

VARIATION. Color patterns are consistent and the number of setae on the callus ranges from 6-8. Some may have been abraded, but setal sockets are difficult to see for finer setae.

HOST. Unknown.

DISTRIBUTION. Virginia (USA).

***Aulogymnus smithi* sp. nov.**

(Figs 5–8, 12, 14)

DIAGNOSIS. This species is most likely confused with *A. californica* as both are primarily yellow with two funiculars. *Aulogymnus smithi* sp. nov. generally has a gaster more yellow with darker banding along the tergal apices only, although some specimens may be suffused with brown ventrally and *A. californica* uniformly dark brown. The uncus of *A. smithi* sp. nov. is 3.50× its length from the apex of the stigmal vein, whereas that of *A. californica* is only 2.30× its length from the apex of the stigmal vein. The occipital maculation at most approaches the eye in *A. smithi* sp. nov. and extends laterally to the eye in *A. californica*.

DESCRIPTION OF FEMALE HOLOTYPE. Body length 2.56 mm. Color: pale yellow with the following pale brown: pedicel dorsoproximally, F2, clava, spot antieriad malar sulcus, area surrounding occipital foramen, mesopleural sulcus, nuchal margin, transverse strips dorsoapically on Gt₁₋₅ (these interconnected by dorsomedial line); or white: circumocular strip in dorsal half eye, interconnected as follows: dorsally both by strip extending posterad lateral ocelli and by strip extending antieriad median ocellus; transverse strip at level of midpoint of medial ocular margin (very faint), this strip angling dorsad along scrobes before uniting into thin line that intercepts strip extending antieriad median ocellus; wing veins pale yellow, hyaline except for brownish stigmal vein and spot appressed to distal end. Sculpture: face finely imbricate-reticulate ventrally becoming slightly coarser dorsally, scrobes similarly sculptured, genae becoming lineolate. Pronotum finely, transversely imbricate; mesoscutum, prepectus reticulate; mesopleuron smoother, finely imbricate-reticulate; propodeum finely reticulate, reticulation finest medially, without median carina; prosternum pentagonal, imbricate with fine median channel; procoxa convex anteriorly, imbricate, with a few sparse, subdecumbent setae along anterior surface; mesepisternum glabrous, in ventral view with median line extending length, sparsely setose apically; scutellum lineolate and lacking shallow submedian lines, interstices conspicuous; certain areas polished or polished with faint reticulation: dorsellum antieriad spiracle, Gt₁; or with reticulation shallower than on dorsum of mesosoma: acropleuron, mesepimeron, metapleuron, and gaster. Head: 0.67× as high as broad, eye height 2.20× malar space; malar sulcus curved; scrobal depression shallow, scrobes uniting at mid-frons before intercepting median ocellus; transverse frontofacial suture present; clypeal apex shallowly bilobate; ratio lateral ocellus:ocellocular distance:postocellar distance as 5:7:15. Antenna: scape reaching just above venter of midocellus; funiculars and club robust; ratio scape (minus radicle):pedicel:A1:A2:F1:F2:club as 21:9:1:1:8:7:17; F1-F2 each increasing in width along length, clava symmetric apically. Mesosoma: pronotum and mesoscutum with sparsely scattered subdecumbent setation, mesoscutum bare medially and two rows of 4 setae subdorsally with stoutest setae near apical margin (additional small seta laterad anterior-most seta on left side), scutellum with two pairs sublateral, stout, subdecumbent setae, one pair in anterior third and one pair near apex, all oriented posteromedially; prepectus triangular, >2.0× size of tegula, surface sculpture similar to lateral pronotum; propodeal spiracle ovate and positioned <1/2 its diameter from dorsellum, median carina absent; callus with 7 erect setae; mesotibia with robust seta apicoposteriorly, at least 2.00× longer than any seta on mesotibia; metacoxa 4.00× as long as broad, 0.80× as long as metafemur; metafemur 4.00× as long as broad; ratio marginal vein:postmarginal vein:stigmal vein as 35:33:23; basal setal line present and cubital setal line terminating 3 setae beyond apex basal setal line; costal cell with row of 9 marginal setae antieriad parastigma, one longitudinal row of setae ventrally extend apical entire length costal cell, uncus 3.50× its length from apex stigmal vein. Metasoma:

elongate, ovate in dorsal view, tapered apically where ovipositor sheaths slightly extruded; gastral petiole visible as transverse, transparent strip in dorsal view, Gt₂ - Gt₇₊₈, ovipositor sheath (all measured dorsally): 11:20:20:22:21:17:11:12; cerci peg-like, roughly 0.75× as long as broad.

Male. Unknown.

ETYMOLOGY. Named in honor of David Smith (USDA, Agricultural Research Service, Plant Science Institute, Systematic Entomology Laboratory (retired) Washington, DC), without whose extensive malaise trapping over the past 20+ years, most of the specimens included herein would not have been collected.

TYPE MATERIAL. **USA: Virginia:** Essex Co.: 1mi. SE Dunnsville, 23.III-11.IV.1995, Malaise trap, D. R. Smith (Holotype, ♀, USNM). Paratypes, 3♀, same data as holotype; 1♀, same data as holotype but date 4-22.iii.1995 (USNM).

VARIATION. Primary variation occurs in extensiveness of the darker maculation on the body: the genal maculation can be absent or extend antieriad malar sulcus toward toruli; occipital maculation can extend ventrad foramen magnum toward ventral mouthparts; mesepisternum may or may not be maculated; dorsal maculation on the gaster ranges from a vague longitudinal smear only through a dorsal smear trending into transverse bands along the apical margins gastral terga with diffuse maculation ventrally to distinct dorsal and ventral transverse bands.

HOST. Unknown.

DISTRIBUTION. Virginia (USA).

Aulogymnus virginiensis sp. nov.

DIAGNOSIS. This species has three funicular segments, but is unlikely to be confused with the other *Aulogymnus* (*A. bouceki* sp. nov. and *A. flavitibiae*) having three funiculars as *A. virginiensis* sp. nov. is primarily orange with faint purple reflections dorsally on the mesosoma propodeum. Both *A. bouceki* sp. nov. and *A. flavitibiae* are metallic blue/green without any purple and have at least some indication of submedian lines on the scutellum, which are lacking in *A. virginiensis* sp. nov..

DESCRIPTION OF FEMALE HOLOTYPE. Body length 2.60 mm. Color: orange-brown with metallic purple-blue reflections as follows: ocellar triangle, mesoscutum, axilla centrally, scutellum and propodeum; tibiae apically and tarsi paler, excluding pretarsomeres brownish; wing veins pale yellow to brown with brown, U-shaped infuscation connecting parastigma and stigmal vein, admarginal area hyaline. Sculpture: face finely imbricate-reticulate, scrobes polished. Mesosoma, propleuron, mesepisternum (anterior to femoral depression), coxae, and metasoma reticulate-imbricate; propodeum finely reticulate, this sculpture finest medially, with faint median carina in anterior half; prosternum pentagonal, transversely reticulate-imbricate with fine median channel; procoxa convex anteriorly, imbricate, with sparse, erect setae along anterolateral margin; mesepisternum reticulate, in ventral view with median line extending length, sparsely setose apically; scutellum lineolate and lacking shallow submedian lines, interstices inconspicuous; certain areas polished or polished with faint reticulation: dorsellum antieriad spiracle, Gt₁; or with reticulation shallower than on dorsum of mesosoma: acropleuron, mesepimeron, metapleuron, and gaster. Head: 0.85× as high as broad (frons/vertex and eyes slightly collapsed), eye height 2.35× malar space; malar sulcus curved; scrobal depression shallow, scrobes uniting at mid-frons before intercepting median ocellus; transverse frontofacial suture very faintly indicated (concurrent with very fine transverse strip/collapse at level of midpoint of medial ocular margin); clypeal apex shallowly bilobate; ratio lateral ocellus:ocellocular distance:postocellar distance as 5:6:18. Antenna: scape reaching just above venter of midocellus; funiculars and club elongate, covered in MPS; ratio scape (minus

radicle):pedicel:anellus:F1:F2:F3:club as 28:12:2:15:12:10:16; F1-F2 each slightly increasing in width along length. Mesosoma: pronotum and mesoscutum with evenly scattered subdecumbent setation, mesoscutum bare medially with stoutest setae near apical margin, scutellum with two pairs sublateral, stout, subdecumbent setae, one pair in anterior quarter and one pair in posterior quarter scutellum, oriented posteromedially; prepectus triangular, $>2.0\times$ size of tegula, surface sculpture similar to lateral pronotum; propodeal spiracle ovate and positioned $\sim 1/2$ its diameter from dorsellum, callus with 18 erect setae; mesotibia with robust seta apicoposteriorly, at least $2.00\times$ longer than any seta on mesotibia; metacoxa $2.47\times$ as long as broad, $0.67\times$ as long as metafemur; metafemur $3.93\times$ as long as broad; ratio marginal vein:postmarginal vein:stigmatal vein as 35:23:22; basal setal line absent and cubital setal line terminating even with base MV; costal cell with row of 4 marginal setae anterior to parastigma, one longitudinal row of setae ventrally extend $4/5$ length costal cell, uncus $2.30\times$ its length from apex stigmatal vein. Metasoma: elongate, ovate in dorsal view, truncate apically (due to retraction of Gt_{7+8} beneath Gt_6 during drying) where ovipositor sheaths slightly extruded; gastral petiole visible as transverse, transparent strip in dorsal view, $Gt_2 - Gt_{7+8}$, ovipositor sheath (all measured dorsally): 30:10:13:17:18:26:?:7; cerci peg-like, roughly as long as broad.

Male. Unknown.

ETYMOLOGY. Commemorative of the Commonwealth from which this species was recovered, Virginia.

TYPE MATERIAL: **USA: Virginia:** Essex Co.: 1mi. SE Dunnsville, 30.IV-13.V.1991, Malaise trap, D. R. Smith (Holotype, ♀, USNM).

HOST. Unknown.

DISTRIBUTION. Virginia (USA).

REMARKS. There exist at least 8 morphospecies of unassociated males in our possession. It may be that certain of these taxa are conspecific with nominal species known only from females. However, until such time as coordinated rearing or experimental mating information becomes available, we shall only mention that these specimens are deposited in the *Aulogymnus* spp. section of the USNM collection. Rearing efforts are underway seeking to obtain more definitive male-female associations. Our information suggests that there are likely many more species to be discovered with additional early spring collecting.

Acknowledgements

We dedicate this paper to Zdeněk Bouček, whose research on world Chalcidoidea remains unsurpassed and forms the foundation for future accomplishments by those who follow, and with best wishes for continued health. We acknowledge the help of Eric Grissell and Gary Miller (USDA, Agricultural Research Service, Plant Sciences Institute, Systematic Entomology Lab), and Greg Evans (USDA, Animal Plant Health Inspection Service) who reviewed the manuscript.

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A review of the genus *Tachysphex* (Hymenoptera: Apoidea) of Turkey, with description of four new species

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Abstract. Based on abundant material collected recently mostly by Czech entomologists and on previously published data, a review of the genus *Tachysphex* Kohl, 1883 in Turkey is presented. Four new species are described: *Tachysphex prismaticus* sp. nov. [*T. pompiliformis* (Panzer, 1805) complex], *T. bouceki* sp. nov. [*T. mongolicus* Kohl, 1898 complex], *T. humilis* sp. nov. and *T. karasi* sp. nov. [both *T. consocius* Kohl, 1892 complex]. Male of *T. punctipes* Pulawski, 1967 [*T. mongolicus* complex] is described for the first time. *T. grandii* de Beaumont, 1965 is recognized as a valid species. Differential diagnosis is provided for *T. punctipes*, *T. consocius* and *T. grandii*. Variability of *T. pompiliformis* and *T. opacus* F. Morawitz, 1893 [both *T. pompiliformis* complex] is discussed. Six other species are recorded from Turkey for the first time. Fifty-two species of *Tachysphex* Kohl, 1883 are now known to occur in Turkey.

Taxonomy, new species, description, validation, distribution, Hymenoptera, Apoidea, Spheciformes, Crabronidae, *Tachysphex*, Palearctic region

INTRODUCTION

Genus *Tachysphex* Kohl, 1883 is placed into the family Crabronidae, tribe Larrini (Menke 1997) and includes approximately four hundred species from all over the world. They can be found in almost all terrestrial habitats, but occur mainly in semiarid areas. Species of *Tachysphex* prey on insects from the orders Blattoptera, Mantodea, Ensifera and Caelifera (Krombein & Pulawski 1994).

There are two comprehensive papers dealing with the genus *Tachysphex* in Turkey. Pulawski (1967) presented the first list of species. Later Hensen & Van Ooijen (1987) added their own findings and those of some other Dutch collectors. Six new species were described in the first one and two in the another paper. Some other information was presented by Pulawski (1971) in his revision of the West Palearctic species. Until recently, forty-one species and four subspecies of *Tachysphex* were known from Turkey.

Many specimens of Crabronidae were collected in Turkey by Czech entomologists over the last fifteen years. A study of this material revealed interesting new data on Turkish *Tachysphex*, including several species new to science. These data are presented in this paper. All the data previously published on the Turkish *Tachysphex* are also reviewed. Currently, fifty-two species and four subspecies of *Tachysphex* are known to occur in Turkey.

MATERIAL AND METHODS

Material from the following institutions and private collections was examined:
BMNH – British Museum, (Natural History), George Else (London, Great Britain);
JSPC – Jakub Straka (Praha, Czech Republic);
HNHM – Hungarian Natural History Museum, Lajos Zombori (Budapest, Hungary);

MRBC – Martin Říha (Brno, Czech Republic);
 MSAC – Maximilian Schwarz (Ansfelden, Austria);
 NHMW – Naturhistorisches Museum Wien, Stefan Schödl (Wien, Austria);
 NMPC – National Museum, (Natural History), Jan Macek (Praha, Czech Republic);
 OLML – Oberösterreichisches Landesmuseum, Fritz Gusenleitner (Linz, Austria);
 PTLC – Pavel Tyrner (Litvínov, Czech Republic);
 ZKZC – Zdeněk Karas (Zlív, Czech Republic);

Geographical names cited in small capitals in the “List of species” refer to the names of PROVINCES. All the sites are located in Turkey, unless an other country is explicitly specified. Usual abbreviations of geographical direction are used: N – North, S – South, E – East, W – West and their combinations, NE, NW, SE, SW.

Morphological terms are as used by Bohart & Menke (1976) and Krombein & Pulawski (1994). The following abbreviations are used in the descriptions of morphometric proportions:

WML – clypeus median lobe width;
 LCL – clypeus maximum length;
 WCL – clypeus width;
 LA3 – length of antennal article III, dorsally;
 WA3 – width of antennal article III, apically, dorsally;
 LA5 – length of antennal article V, dorsally;
 WA5 – width of antennal article V, apically, dorsally;
 WV – vertex width;
 LV – vertex length;
 MOD – diameter of median ocellus;
 LF1 – forefemur length;
 WF1 – forefemur width, laterally.

General information on Geographic distribution is compiled from Pulawski (1971) and Krombein & Pulawski (1994).

Interpretation of species groups follows Pulawski (1971) except for “*Incertae sedis*” and *Tachysphex schmiedeknechti* Kohl, 1883. *Tachysphex mochii* (Beaumont, 1947) cited by Pulawski (1967) from Turkey is omitted from the present list as it was transferred to a related genus *Holotachysphex* Beaumont, 1940 (Pulawski 1972).

All the newly described species were labelled as follows: “HOLOTYPUS ♂ or ♀, name of taxon sp. nov., J. Straka det. 2004” on red card; paratypes analogously on yellow card. Exact label data are cited for the holotype only. Separate lines on a label are indicated by a slash “/” and separate labels by a double slash “//”.

LIST OF SPECIES

Tachysphex pompiliiformis species group

Tachysphex agnus Pulawski, 1971

Pulawski 1971: 152–154, figs 79–80.

PUBLISHED RECORDS. **Ankara**: above Hasanoglan, 1500 m, 29.vi.1962, 1 ♀, K. M. Guichard and D. H. Harvey leg., paratype (Pulawski 1971).

GEOGRAPHIC DISTRIBUTION. North Africa, Israel and Turkey.

COMMENTS. The holotype comes from Tunisia. Cited specimen was not found in the BMNH collection.

Tachysphex angustatus Pulawski, 1967

Pulawski 1967: 405–408, figs 28–30; 1971: 170–172, figs 97–99; Hensen & Van Ooijen 1987: 12.

PUBLISHED RECORDS. **Amasya**: Amasya, 500 m, 22.–24.v.1959, 1 ♂, Amasya, 700 m, 18.vii.1959, 1 ♂, K. M. Guichard leg.; **Konya**: Konya, 15.vi.1965, 3 ♂♂, J. Gusenleitner and M. Schwarz leg. (Pulawski 1967, 1971); **Bingöl**: Genç, 1000 m, 12.viii.1985, 1 ♀, R. Hensen leg. (Hensen & Van Ooijen 1987).

MATERIAL EXAMINED. Malatya: Kale 30 km E, 27.vi.2000, 1 ♂, M. Halada leg., OLML; **Urfa**: Halfeti env., 3.–5.v.1994, 2 ♂♂, M. Halada and K. Deneš sen. leg., OLML.

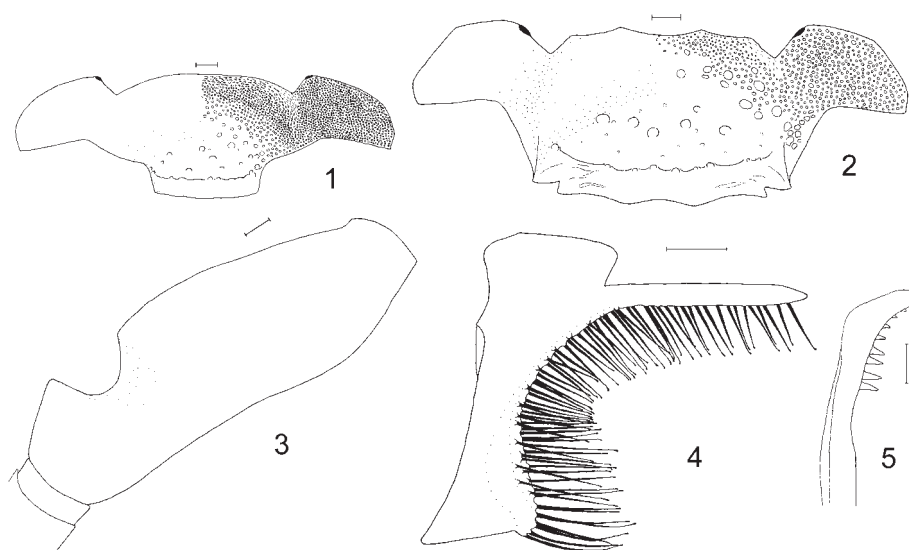
GEOGRAPHIC DISTRIBUTION. Greece to Mongolia.

***Tachysphex bouceki* sp. nov.**

(Figs 1–5)

TYPE MATERIAL. **Holotype:** Turkey, **Kayseri**, ♂, labelled: “TURKEY 24.VIII.2003 / Kayseri vill. (25 km S) / 7 km NW DEVELI // Turkey 2003 Expedition / cca 1600 m / J. Straka leg.”, printed label. Holotype in OLML. **Paratypes:** Turkey: **Adiyaman:** Nemrut dag, 2000 m, 16.viii.1991, 1 ♀, M. Halada leg., OLML; **Bayburt:** Bayburt 10 km N, 1600 m, 22.viii.1991, 1 ♀, M. Halada leg., OLML; **Kayseri:** Develi 7 km NW, 1600 m, 24.vii.2003, 1 ♂, 1 ♀, J. Straka leg., JSPC.

DIAGNOSIS. *Tachysphex bouceki* sp. nov. is a member of *T. mongolicus* Kohl, 1898 species complex. This species complex is defined in the following combination of characters. ♂, ♀: sculpture on mesopleuron dull, slightly punctate, or impunctate, or rugose; gaster without silver apical bands (except *T. punctipes* Pulawski, 1967); ♂: forebasitarsus with rake; Venter of forefemur between notch and the base sparsely punctate, interspaces unsculptured, shiny (missing in *T. mysticus* Pulawski, 1971); inner side of volsella with ledge (in a few species missing); ♀: clypeal bevel large, reaching base of clypeus in the middle; clypeal lip with lateral incisions (except *T. splendidulus* F. Morawitz, 1893) and more or less distinct median emargination (distinct in fresh specimens); fore- and midfemoral venter with distinct large punctures, this punctures sometimes intermixed with smaller punctures. *T. bouceki* resembles *T. nasalis* F. Morawitz, 1893 sensu Pulawski (1971), *T. morawitzi* Pulawski, 1971, *T. mongolicus*, *T. abditus* Kohl, 1898, *T. splendidulus*, *T. mysticus*, *T. excelsus* R. Turner, 1917 and *T. punctipes*. It differs from these species in the following combination of characters. ♂: mandible with two distinct inner teeth; setae on vertex about 1 x MOD long; postocellar impression deep; forefemoral notch deep, semicircular (Fig. 3); forebasitarsal rake developed; all terga and apical depressions relatively densely punctate; volsella characteristic (Fig. 4).



Figs 1–5. *Tachysphex bouceki* sp. nov.; 1 – male clypeus, 2 – female clypeus, 3 – male forefemur, lateral view, 4 – volsella, inner side view, 5 – penis valve; scale bar = 0.1 mm.

♀: clypeal basomedian area small, densely punctate, nearly as densely as the lateral section (Fig. 2); setae on vertex about 1 x MOD long; postocellar impression deep, Y-shaped; forefemur with small and large punctures, small punctures usually one to two diameters apart, interspaces unsculptured; Venter of fore- and midfemora with narrow area with large punctures and unsculptured interspaces; at least the basal half of pygidial plate with microsculptured interspaces between punctures.

DESCRIPTION OF HOLOTYPE. Male. Body length: 8.5 mm.

Head. Mandible with two distinct inner teeth. Labrum almost flat, margin rounded. Clypeus (Fig. 1) distinctly convex; basomedian area relatively large, densely punctate; bevel extremely convex to abrupt, as long as the basomedian area, shiny with several large punctures; lip arcuate. Antennae relatively short. Frons and vertex densely and uniformly punctate, punctures deep, less than one diameter apart, interspaces shiny; frontal median line distinct. Vertex setae about 1 x MOD long; postocellar impression deep and Y-shaped.

Thorax. Scutum and scutellum densely, uniformly punctate, punctures deep, less than one diameter apart, on side of scutum without interspaces, interspaces distinct at centre, shiny; setae about 1.5 x MOD long. Mesopleuron punctate, punctures evanescent in coarsely microsculptured interspaces; hypoepimeral area rugose, without distinct punctures. Mesosternal punctures about one diameter apart or less, interspaces shiny. Propodeal dorsum irregularly rugose. Propodeal side obliquely ridged, interspaces microsculptured, shiny to dull. Venter of fore- and hindtrochanters with punctures about one to two diameters apart, interspaces shiny, slightly microsculptured; Venter of midtrochanter with a few large punctures, their interspaces shiny, slightly microsculptured. Forefemur thick, punctures about one to two diameters apart, interspaces shiny; forefemoral notch large (Fig. 3), surface unsculptured. Midfemoral venter with large punctures several diameters apart, without small punctures, interspaces large, shiny, slightly microsculptured. Hindfemur densely punctate, punctures small. Forebasitarsal rake developed, with three long spines (their apex broken off); tarsomeres II and III each with apical spine almost as long as the following tarsomere. Wings slightly infumate; veins brown.

Gaster. Terga I-IV with indistinct amber apical bands. Terga densely micropunctate including apical depressions, interspaces shiny, microsculptured; sculpture on tergum VII coarser. Sterna uniformly micropunctate nearly like terga. Sternum VIII with small obtuse tooth between two apicolateral teeth. Gonostyle with more than 20 setae on the three quarters of their length; setae slightly continuously shortening towards the apex. Volsella light brown, characteristic (cf. Fig. 4), base of ventral setae extremely wide. Penis valve cf. Fig. 5.

Coloration. Mandible apically, tarsi (except basitarsus proximally) and gastral segments I-III red. Apical parts of terga I-III distinctly translucent. Tegula reddish translucent. Apical parts of terga I-III distinctly translucent. Other body parts all black.

VARIABILITY OF MALES. Body length: 8.5-10.0 mm.

Head: WML:LCL = 0.9, 1.2, WCL:WML = 3.5, 3.8. LA3:WA3 = 1.7, 1.8, LA5:WA5 = 2.1, 2.2. WV:LV = 1.4.

Thorax. Forebasitarsal rake with three long spines, apical spine probably about three quarters of length of tarsomere II (apex of spines broken in both specimens).

GENERAL DESCRIPTION OF FEMALE. Body length: 9.5-12.0 mm.

Head. Labrum almost flat, margin rounded. Clypeus distinctly convex (Fig. 2), top between the middle and the first quarter of clypeus; basomedian area small, densely punctate, nearly as densely as lateral section; bevel large, convex with several large punctures, shiny; lip sinuate with lateral incisions and shallow median emargination in fresh specimens, separated from bevel by deep, punctate groove; WML:LCL = 1.5, WCL:WML = 2.0. Antennae relatively short, LA3:WA3 = 2.3-

2.4, LA5:WA5 = 2.7-2.9. Frons and vertex uniformly punctate, punctures deep, one diameter or less apart, interspaces shiny or dull, microsculptured; frontal median line distinct, deep. Vertex setae about 1 x MOD long; postocellar impression Y-shaped, deep; WV:LV = 1.1-1.2.

Thorax. Scutum with anterior impression; anterior part densely, uniformly punctate, punctures small, less than one diameter apart, interspaces shiny; other parts of scutum and scutellum irregularly, sparsely punctate, with small punctures intermixed with large ones, punctures one to several diameters apart, interspaces almost unsculptured; setae shorter than 1 x MOD. Mesopleuron coarsely microsculptured, dull, punctures more distinct in its lower part, interspaces slightly shiny; hypoepimeral area rugose, superficially punctate, punctures less distinct. Mesosternal punctures small, about one diameter apart or less, interspaces shiny. Propodeal dorsum finely, irregularly rugose. Propodeal side obliquely ridged, interspaces microsculptured or unsculptured, shiny to dull. Venter of all trochanters with a few large punctures, interspaces shiny, slightly microsculptured to unsculptured. Forefemur with small and large punctures, small punctures usually one to two diameters apart, interspaces unsculptured; Fore- and midfemoral venter with a narrow area with large punctures and unsculptured interspaces; LF1:WF1 = 3.0-3.1. Forebasitarsal rake reddish, with three relatively thick apical spines and one additional preapical spine. Wings slightly infumated, veins brown.

Gaster. All terga lacking apical bands. Terga I-IV sparsely micropunctate, apical depressions with or without punctures, interspaces shiny, finely microsculptured, punctures larger and denser on tergum VI, one diameter apart, apical depression impunctate, interspaces coarsely microsculptured. Pygidial plate distinctly, irregularly punctate, at least basal half with microsculptured interspaces between punctures. Central part of sternum II with several distinct punctures, interspaces microsculptured, shiny, lateral part dull, densely micropunctate, remaining sterna with uniform sculpture similar to that on sternum II, but sculpture more or less reduced laterally.

Coloration. Central part of mandible, apical tarsal segments (individually variable), gastral segments I-II and apical half of tergum III red. Tegula brown translucent. Apical parts of terga I-II distinctly translucent. Other body parts all black.

GEOGRAPHIC DISTRIBUTION. Central and eastern Turkey.

ETYMOLOGY. Named in honour of the Czech hymenopterist, Zdeněk Bouček.

COMMENTS. The specimen listed by Pulawski (1967) as *T. mongolicus* (Turkey: Kars: Little Ararat, 3000-3600 m, 2.ix.1960, 1 ♀, K. M. Guichard and D. H. Harvey leg., BMNH) may be *T. bouceki* sp. nov.

Tachysphex consocius Kohl, 1892

Pulawski 1971: 185–189, figs 110–116.

T. cabrerai Mercet, 1909: Pulawski 1967: 408; synonymized by Pulawski (1971).

PUBLISHED RECORDS. **Hatay:** Antakya, 1.-7.vi.1965, 1 ♀, 10 ♂♂, J. Gusenleitner and M. Schwarz leg.; **Içel:** Tarsus, 29.-31.v.1965, 2 ♂♂, J. Gusenleitner and M. Schwarz leg.; **Tekirdag:** 24 km from Malkara on Malkara – Inecik road, 12.viii.1962, 1 ♂, K. M. Guichard and D. H. Harvey leg. (Pulawski 1967); **Istanbul:** Istanbul, without details (Pulawski 1971).

MATERIAL EXAMINED. **Içel:** Büyükeçeli (Ovaçık) env., 70 m, 14.-18.vii.1998, 2 ♀♀, M. Řiha leg., MRBC.

GEOGRAPHIC DISTRIBUTION. Portugal and Morocco to Kazakhstan and India.

COMMENTS. *T. consocius* sensu Krombein & Pulawski (1994) is a complex of several similar species. For diagnostic characters of this species complex see diagnosis under *T. grandii*. Six species occur in the Palearctic region and about five in Sub-Saharan Africa. *T. grandii* de Beaumont, 1965, *T. humilis* sp. nov. and *T. karasi* sp. nov. belong to this species complex. Description of *T. consocius* by Pulawski (1971) is correct.

Tachysphex ferrugineus Pulawski, 1967

Pulawski 1967: 401–403, figs 22–25; 1971: 70–72.

PUBLISHED RECORDS. **Trabzon** (Pulawski 1967, 1971).

MATERIAL EXAMINED. **Artvin**: Damar env., 2.vii.1997, 1 ♂, 1 ♀, P. Průdek and M. Říha leg., JSPC; **Trabzon**: Boztepe, 18.v.1962, 4 ♂♂, 1 ♀, K. M. Guichard and D. H. Harvey leg., BMNH.

GEOGRAPHIC DISTRIBUTION. Georgia, South of European Russia and Turkey.

Tachysphex fugax (Radoszkowski, 1877)

Pulawski 1971: 178–182, figs 105–106; Hensen & Van Ooijen 1987: 12.

PUBLISHED RECORDS. **Bursa**: Karacabey 10 km S, 1 ♂, without other details (Pulawski 1971); **Istanbul**: Aandolu-kavagi, Üsküdar 25 km N, 15.vii.1985, 1 ♀, P. D. J. van Ooijen leg.; **Urfa**: Halfeti, 425 m, 7.viii.1985, 1 ♀, R. Hensen leg. (Hensen & Van Ooijen 1987).

MATERIAL EXAMINED. **Bursa**: Çağliyan env., 10.–14.vii.1997, 2 ♂♂, 1 ♀, P. Průdek and M. Říha leg., JSPC, MRBC.

GEOGRAPHIC DISTRIBUTION. Croatia to southern parts of Central Asia; recorded also from Austria (Gusenleitner 1998).

Tachysphex fulvitaris (A. Costa, 1867)

Pulawski 1967: 405; 1971: 90–95, figs 20–25.

PUBLISHED RECORDS. **Ankara**, **Antakya**, **Artvin**, **Içel**, **Istanbul**, **Kayseri**, **Konya**, **Sinope** (Pulawski 1967, 1971).

MATERIAL EXAMINED. **Adana**: Boztahta 1 km W, Adana 45 km N, 330 m, 24.vi.2001, 1 ♂, M. Fikáček, J. Hájek and J. Straka leg., JSPC; **Edirne**: Edirne env., 225 m, 16.vi.2001, 1 ♂, 1 ♀, M. Fikáček, J. Hájek and J. Straka leg., JSPC; **Eskişehir**: Sakariilica near Gümele, Eskişehir 30 km N, 6.–9.vii.1997, 1 ♂, P. Průdek and M. Říha leg., JSPC; **Kayseri**: Develi 7 km NW, 1600 m, 24.vii.2003, 1 ♀, J. Straka leg., JSPC; **Van**: Muradiye env., Van 120 km NE, 2000 m, 5.vi.2001, 1 ♂, K. Deneš sen. leg., OLML.

GEOGRAPHIC DISTRIBUTION. Widely distributed in the Palearctic region.

COMMENTS. A common species.

Tachysphex grandii de Beaumont, 1965, sp. revocata (Fig. 6)

Pulawski 1967: 408; 1971: 182–185, figs 107–109.

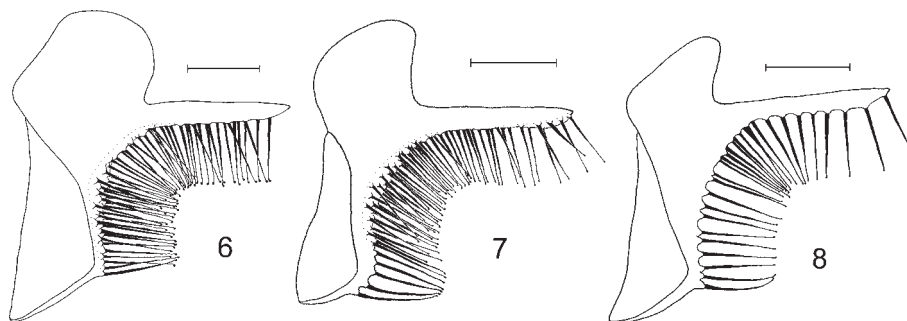
Synonymized with *T. consocius* by Pulawski in Krombein and Pulawski (1994): 28.

TYPE MATERIAL EXAMINED. **Paratypes**: Greece: **Peloponnesus**: Zachlorou, 30.v.1962, 1 ♂, 29.v.1964, 1 ♀, M. Schwarz leg., MSAC.

ADDITIONAL MATERIAL EXAMINED. Austria: **Niederösterreich**: Bernhardstal, 11.vii.1985, 1 ♂, J. Gusenleitner leg., Geinfarn, Bad Vöslau W, 290 m, 26.viii.1995, 1 ♀, J. Gusenleitner leg., **Steirmark**: Therme Loipersdorf, 12.v.1998, 6 ♂♂, 3 ♀♀, F. Gusenleitner leg., **Burgenland**: Tauka, 300 m, 18.v.2000, 1 ♀, F. Gusenleitner leg., 11.vii.2001, 1 ♀, J. Gusenleitner leg., Schützengraben, Minihof-Liebau E, 370 m, 1 ♀, J. Gusenleitner leg., OLML; and additional 1 ♂ and 6 ♀♀, NHMW, OLML; Bulgaria: **Burgas**: Burgas, 15.vii.1985, 1 ♀, red form, J. Papp leg., HNHM, Sandanski, 1.–8.vi.1967, 1 ♂, Slănčev Brjag, 2.viii.1968, 1 ♀, red form, vi.1969, 1 ♂, 10.vi.1972, 1 ♂, 1 ♀, red form, M. Kocourek leg., 18.–30.v.1989, 4 ♂♂, J. Halada leg., OLML, Ropotamo, 5.vii.1986, 1 ♀, Z. Karas leg., ZKZC; **Plovdiv**: Plovdiv, vii.1969, 1 ♀, red form, K. Deneš sen. leg., OLML; **Croatia**: Dobrogea, Istria, 28.vi.1969, 1 ♀, L. Móczár leg., HNHM; Drvenik, Makarska env., 11.–22.vi.2000, 1 ♀, M. Kafka leg., JSPC; Czech Republic: **Bohemia**: Houšťka, 27.vii.1909, 1 ♀, red form, O. Šustera leg., NHMW; Hradec Králové env., 250 m, vii.1948, 1 ♀, V. Balthasar leg., NMPC; Veselí nad Lužnicí, 410 m, 28.7.1985, 1 ♂, Z. Karas leg., ZKZC;

Cihelna v Bažantnici, Praha-Hloubětín, 260 m, 28.v.1998, 1 ♂, 22.vi.1998, 3 ♂♂, 1 ♀, Chvalský lom, Praha-Horní Počernice, 260 m, 15.vii.1999, 1 ♀, Podbabské skály, Praha-Sedlec, 250 m, 9.vi.2002, 5 ♂♂, 1 ♀, 14.vi.2002, 1 ♂, 1 ♀, 1.vii.2002, 2 ♀♀, J. Straka leg., JSPC; and additional 11 ♂♂ and 16 ♀♀, JSPC, NHMW, NMPC, OLML; **Moravia:** Mutěnice env., 200 m, viii.1941, 1 ♀, 27.vii.1949, 1 ♀, V. Balthasar leg., Kobylí env., 200 m, vi.1943, 1 ♀, J. Pospíšil leg., NMPC; Pálava Protected Landscape Area, 300 m, 16.vi.1986, 1 ♂, Z. Karas leg., ZKZC; Pánov, 200 m, 22.vi.-2.ix.2002, 1 ♀, D. Vepřek leg., JSPC; and additional 1 ♂ and 3 ♀♀, NMPC; Greece: **Attica:** Corynth 3 km W, 27.iv.1987, 1 ♂, J. Schmidt leg., OLML; **Hungary:** Ór Sz. Miklós, vii.1913, 2 ♀♀, red form, Sajó leg., Simontornya, 15.vii.1932, 1 ♀, Pilich leg., Tóközpuszta, 25.vi.1953, 1 ♀, Bajári leg., Tompa, 25.vii.1962, 1 ♀, Mihályi leg., Zamárdi, 10.-18.vii.1965, 1 ♀, red form, L. Móczár leg., Ásotthalom, 19.vii.1972, 1 ♀, red form, L. Gallé leg., Kis-Pöse, date missing, 1 ♀, Méhely leg., HNHM; Sándorfalva env., 9.viii.1999, 1 ♀, red form, Örkeny 2 km W, 180 m, 16.viii.2000, 2 ♀♀, J. Straka leg., JSPC; Italy: **Sicilia:** Collesano env., Madonie, 300 m, 3.-5.vi.2002, 1 ♂, J. Halada leg., JSPC; **Jordan:** Wadi Ramm, 12.v.1995, 1 ♂, K. Deneš sen., OLML; **Kazakhstan:** Aksay 20 km SE, 16.-19.vi.1992, 2 ♂♂, J. Halada leg., Alma-Ata, 25.vi.1992, 1 ♀, K. Deneš sen., 1.vi.1994, 1 ♂, J. Halada leg., OLML; **Portugal:** Lisboa, 10.vi.1951, 1 ♀, N. F. de Andrade leg., NMPC; Serbia: **Vojvodina:** Susara, Deliblatska Pescara, 2.vii.1969, 1 ♂, 1 ♀, red form, H. Malicky leg., OLML; **Slovakia:** "Piesting", 17.vii.1869, 1 ♀, Kohl leg., NHMW; Vinický, Baba, vi.1952, 1 ♀, red form, M. Kocourek leg., Chotín, 22.vii.1962, 1 ♀, Z. Pádr leg., OLML; Štúrovo (Parkan), vii.1967, 1 ♀, V. Balthasar leg., NMPC; Spain: **Andalucía:** Coin, 19.v.1985, 1 ♂, J. Schmidt, OLML; Turkey: **Ankara:** Kizilcahamam env., 9.vii.2000, 2 ♀♀, M. Halada leg., OLML; **Bitlis:** Tatvan 30 km E, 7.vii.1997, 1 ♂, M. Halada leg., OLML; **Bursa:** Çagliyan env., 20.-23.vii.1998, 1 ♀, M. Říha leg., MRBC; **Erzurum:** Erzurum E, 2000 m, 6.vii.2000, 1 ♂, M. Halada leg., OLML; **Konya:** Sille env., 7.vi.1978, 1 ♂, M. Schwarz leg., JSPC; **Nevşehir:** Ürgüp 10 km W, 15.vi.1998, 1 ♂, M. Halada leg., OLML; **Sivas:** Şerefiye area, 1500 m, 7.vii.1960, 1 ♀, K. M. Guichard and D. H. Harvey leg., BMNH; **Van:** Muradiye 10 km N, 27.vi.1997, 3 ♂♂, M. Halada leg., Van 20 km W, 5.vii.1997, 1 ♂, M. Halada leg., Muradiye, 2200 m, 5.vii.2000, 1 ♂, M. Halada leg., OLML; Ukraine: **Kherson:** Ivanovka, v.2000, 1 ♀, V. Gurko leg., OLML.

DIAGNOSIS. *T. grandii* is a member of a complex of several sibling species (see also the comment under *T. consocius*). This species complex is defined in the following combination of characters. ♂, ♀: sculpture on mesopleuron with distinct punctures, their interspaces unsculptured to slightly microsculptured, shiny to dull; ♂: antennae with two differently sculptured setose areas and more or less distinct longitudinal line between them; ♀: clypeal lip slightly pointed medially and with distinct lateral incisions. *T. grandii* resembles *T. consocius*, *T. humilis* sp. nov., *T. karasi* sp. nov. and Sub-Saharan *T. minutus* Arnold, 1923. Individual species can be recognized by a combination of several characters. A reliable determination of some extreme specimens can be difficult. *T. grandii* differs from the other related species by a characteristic sculpture of the mesopleuron



Figs 6–8. *Tachysphex grandii* de Beaumont, 1965 (6), *T. humilis* sp. nov. (7), *T. karasi* sp. nov. (8); volsella, outer side view; scale bar = 0.1 mm.

composed of small ill defined punctures (thrusted like), shallow to indistinct especially on the hypoepimeral area and becoming more distinct ventrally, with shiny interspaces; setae on the vertex and venter of midfemur are shorter than $1 \times \text{MOD}$; the mid- and hindtrochanters with small punctures one to two diameters apart, sometimes with a few large punctures; and especially the characteristic volsella (Fig. 6). Females of *T. grandii* occur in two colour forms, one all black, the other with gastral segments I-II red. Red form is not known in any other closely related species.

GENERAL DESCRIPTION OF MALE. Body length: 4.0–6.5 mm.

Head. Glossa and galea short, approximately as long as half of scapus length, in all examined specimens. Mandible with one distinct inner tooth. Labrum flat, margin variable, usually rounded. Clypeus distinctly convex; basomedian area densely punctate; bevel shorter than basomedian area (usually about $1/3$ of basomedian area), shiny with several large punctures and with large punctures near margin between bevel and basomedian area; lip usually slightly pointed; $\text{WML:LCL} = 1.4\text{--}1.6$, $\text{WCL:WML} = 2.1\text{--}2.4$. Antennae short; articles III–XIII with two differently sculptured setose areas; article V distinctly thicker than the article XIII; $\text{LA3:WA3} = 1.6\text{--}2.0$, $\text{LA5:WA5} = 1.5\text{--}1.7$. Frons very densely punctate, with linear interspaces to rugose with distinct punctures, punctures relatively variable in size, interspaces (if distinct) usually shiny; frontal median line ill defined. Vertex usually with well-developed punctures, half to two diameters apart, interspaces unsculptured, shiny; setae distinctly shorter than $1 \times \text{MOD}$; postocellar impression distinct, relatively shallow, in most specimens impressed as narrow obtuse V-line; $\text{WV:LV} = 1.7\text{--}2.0$.

Thorax. Scutum and scutellum densely punctate, punctures well defined, rarely shallow, less than one diameter apart, interspaces distinct, unsculptured. Mesopleuron with shallow to indistinct punctures on hypoepimeral area and posterior part, ventrally becoming more distinct and well defined, interspaces unsculptured, shiny, variable in size. Mesosternal punctures one to three diameters apart, interspaces unsculptured. Propodeal dorsum irregularly rugose with more or less distinct longitudinal ridges. Propodeal side obliquely ridged, interspaces shiny. Venter of all trochanters with small punctures about one diameter apart, interspaces slightly shiny. Forefemur with small ill-defined punctures several diameters apart, interspaces unsculptured; forefemoral notch medium sized, surface unsculptured. Midfemoral venter of midfemur with setae distinctly shorter than $1 \times \text{MOD}$. Forebasitarsal rake absent. Wings almost hyaline, slightly infumated apically; veins brown.

Gaster. Terga I–III (I–IV in some specimens) with distinct silvery apical bands. Terga and apical depressions densely micropunctate, interspaces shiny; sculpture on tergum VII coarser. Sterna uniformly micropunctate nearly like terga. Sternum VIII with more or less distinct obtuse tooth between two apicolateral teeth. Gonostyle with less than 20 setae on apical half; most setae equal in length. Volsella brown, characteristic (Fig. 6); base of ventral setae distinctly wide; setae not in one line. Penis valve variable; dentate apex slightly inflexed, relatively long, with four to ten teeth.

Coloration. Mandible apically and apical tarsal segments more or less red. Tegula reddish translucent. Other body parts all black.

GENERAL DESCRIPTION OF FEMALE. Body length: 5.5–7.5 mm.

Head. Glossa and galea short, approximately as long as half of scapus length, in all examined specimens. Labrum flat, margin variable, rounded in most specimens. Clypeus distinctly convex; basomedian area small, densely punctate; bevel large, sometimes reaching base of clypeus, convex with several very large punctures, shiny; lip sinuate, with lateral incisions, separated from the bevel by large deep punctures; $\text{WML:LCL} = 1.6\text{--}1.8$, $\text{WCL:WML} = 1.9\text{--}2.0$. Antennae relatively short; $\text{LA3:WA3} = 2.5\text{--}2.7$, $\text{LA5:WA5} = 2.3\text{--}2.6$. Frons densely punctate, punctures variable in size, interspaces distinct, usually coarsely microsculptured, dull or slightly shiny; frontal median line distinct. Vertex with well-developed punctures, less than half to two diameters apart, interspaces

unsculptured, shiny; setae distinctly shorter than 1 x MOD; postocellar impression distinct, relatively shallow, in most specimens impressed as a narrow obtuse V-shaped line; WV:LV = 1.5-1.6.

Thorax. Scutum and scutellum densely punctate, punctures well defined, less than one to two diameters apart, interspaces distinct, unsculptured. Mesopleuron with shallow to indistinct punctures on hypopimeral area and posterior part, ventrally becoming more distinct and well defined, interspaces usually unsculptured, shiny, variable in size. Mesosternum with ill-defined punctures one to several diameters apart, interspaces unsculptured. Propodeal dorsum irregularly rugose with more or less distinct irregular longitudinal ridges. Propodeal side obliquely ridged, interspaces unsculptured, shiny. Mid- and hindtrochanteral ventr with small punctures one to two diameters apart, in some specimens with a few large punctures. Forefemur with small, ill-defined punctures, several diameters apart, interspaces unsculptured; Venter of midfemur with setae distinctly shorter than 1 x MOD. Forebasitarsal rake amber, with three apical spines and with one preapical spine. Wings almost hyaline; veins brown.

Gaster. Terga I-IV with distinct silvery apical bands; in some specimens of red form terga I-III with distinct silvery apical bands. Terga I-III and all apical depressions distinctly micropunctate, interspaces microsculptured, shiny; terga IV-V sparsely sculptured, punctures indistinct. Pygidial plate distinctly irregularly punctate, interspaces variable, in most specimens shiny. Central part of sternum II with several distinct large punctures, interspaces microsculptured, shiny; lateral part dull to shiny, densely micropunctate; remaining sterna with uniform sculpture similar to that on sternum II, but more or less reduced laterally.

Coloration. Two colour forms; one all black; the other with gastral segments I-II red. Central part of mandible and apex of pygidial plate in both forms red. Apical tarsal segments (individually variable) brown. Tegula reddish translucent. Apical parts of terga I-II in the red form distinctly translucent. Other body parts all black. Very rarely, intermediate specimens between the red and black forms can be found, in which basal half of gastral segments I-II is red.

GEOGRAPHIC DISTRIBUTION. Portugal to Kazakhstan, so far not recorded from North Africa.

COMMENTS. Holotype: ♂, Italy: Bologna: Gaibola, in Bologna University (Beaumont 1965). Records from 1965 to recent of *T. grandii* refer to several species in publications, therefore they cannot be used for a characteristic of the geographical distribution of this species. The holotype was not examined; however, this is the only species occurring in Italy.

***Tachysphex helveticus* Kohl, 1885**

Pulawski 1967: 408; 1971: 172-176, figs 100-104.

PUBLISHED RECORDS. **Ankara**: Ankara env., v.1925, 1 ♀, Biró leg., **Kayseri** (Pulawski 1967); **Istanbul**, without details (Pulawski 1971).

MATERIAL EXAMINED. **KAYSERI**: Sultanhani, 1200 m, 13.vi.1962, 1 ♀, 15.vi.1962, 1 ♂, 1 ♀, K. M. Guichard and D. H. Harvey leg., BMNH.

GEOGRAPHIC DISTRIBUTION. Almost the whole Palearctic region.

***Tachysphex humilis* sp. nov.**

(Fig. 7)

TYPE MATERIAL. **Holotype**: Jordan, ♂, labelled: "JORDAN west. / 10km N of Petra / 3.V.1996/ leg.Mi.Halada ing.", printed label. Holotype in OLML. **Paratypes**: Jordan: Petra 10 km N, 3.v.1996, 3 ♂♂, M. and Mi. Halada leg., OLML, JSPC; Kazakhstan: Makbal, Dzhambul 60 km E, Kirgizskiy Mts., 4.vi.1980, 1 ♀, Z. Pádr leg., OLML; Kyrgyzstan: Tal-di-Bulag, Talas 90 km E, 5.vii.1992, 1 ♂, M. Halada leg., Neldy, Talas 20 km NW, Kirgizskiy Mts., 1800 m, 11.vi.1996, 1 ♂, S. Zonstein leg., Kuzu-Tegerek, Sandelashsky Mts., vii.1998, 1 ♀, V. Gurko leg, OLML;

Dzahal-Abad province, vi.2000, 1 ♀, V. Gurko leg., JSPC; **Syria**: Bloudan, 16.v.1995, 1 ♀, K. Deneš sen. leg., Şalkhad, 6.v.1996, 2 ♀♀, M. Halada leg., Rankus, 23.v.1996, 2 ♂♂, M. Halada leg., OLML; **Uzbekistan**: Shalcan, Kughitangtau, Pashkurd 15 km SW, 1500 m, 30.v.1997, 1 ♀, S. Zonstein leg., OLML.

ADDITIONAL MATERIAL EXAMINED. Turkey: **Içel**: Uzuncaburç, Silifke 30 km N, 28.v.1996, 1 ♀, M. Halada leg., OLML; **SIRNAK**: Bozkiş, 26.v.1998, 1 ♂, M. Halada leg., OLML; **Gaziantep**: Gaziantep 30 km W, 30.v.1998, 1 ♀, M. Halada leg., OLML; **Mugla**: Gölbaşı 25 km E, 7.vi.1998, 1 ♀, M. Halada leg., OLML; **Nevşehir**: Ürgüp, 13.vi.1998, 4 ♂♂, 4 ♀♀, Ürgüp 10 km W, 15.vi.1998, 1 ♂, 1 ♀, M. Halada leg., OLML, JSPC; **Adana**: Tufanbeyli, 8.vi.2001, 1 ♂, M. Snížek leg., OLML; **Erzurum**: Tekederesi env., Erzurum 15 km SW, 2700 m, 3.vii.2001, 1 ♀, M. Fikáček, J. Hájek and J. Straka leg., JSPC.

DIAGNOSIS. *T. humilis* sp. nov. is a member of a complex of several sibling species (see also the comment under *T. consocius* and diagnosis under *T. grandii*). *T. humilis* sp. nov. differs from *T. consocius*, *T. grandii*, *T. karasi* sp. nov. and *T. minutus* by a characteristic sculpture of the female mesopleuron: large punctures distinct on lower half, half to one diameter apart, punctures on the hypopleural area well developed, interspaces slightly shiny to dull, coarsely microsculptured, in the smallest specimens microsculpture ill defined, setae on the vertex and lower part of midfemur are shorter than 1 x MOD, mid- and hindtrochanters of female with a few large punctures only, in males with distinct dense micropunctuation; and especially the characteristic volsella (Fig. 7), in some specimens somewhat resembling extremely developed volsella of *T. grandii*. *T. humilis* sp. nov. varies considerably in some characters, e.g., in the scutal punctures in the female ranging from uniformly dense, less than one diameter apart, to variably sparse, half to many diameters apart.

DESCRIPTION OF HOLOTYPE. Male. Body length: 5.0 mm.

Head. Glossa and galea short, approximately as long as half of scapus length. Mandible with one inner tooth. Labrum flat, margin probably rounded (hardly visible). Clypeus distinctly convex; basomedian area densely punctate; bevel slightly longer than basomedian area, shiny with several small punctures; lip slightly pointed. Antennae short; articles III–XIII with two distinct differently sculptured and setose areas; article V slightly thicker than last article. Frons densely punctate with small interspaces, punctures relatively large, variable in size, interspaces slightly shiny; frontal median line ill defined, almost missing. Vertex with well-defined punctures half to several diameters apart, interspaces shiny; setae distinctly shorter than 1 x MOD; postocellar impression distinct, shallow and large.

Thorax. Scutum and scutellum with well-defined punctures one diameter or less apart, interspaces shiny. Mesopleuron with distinct punctures on hypopleural area, punctures one to three diameters apart, interspaces slightly microsculptured, slightly shiny; other parts on mesopleuron relatively uniformly punctate, punctures well defined, interspaces one diameter or less apart, distinctly microsculptured. Mesosternal punctures one to two diameters apart, interspaces unsculptured. Propodeal dorsum coarsely sculptured with irregularly rugose ridges, interspaces slightly shiny. Propodeal side indistinctly obliquely ridged, interspaces shiny. Venter of all trochanters with small punctures about one diameter apart, interspaces slightly shiny. Forefemur with small distinct punctures several diameters apart, interspaces unsculptured; forefemoral notch medium sized, surface unsculptured. Venter of midfemur with setae distinctly shorter than 1 x MOD. Forebasitarsal rake absent. Wings almost hyaline; veins brown.

Gaster. Terga I–III with distinct, but weakly developed silvery apical bands. Terga distinctly micropunctate, interspaces shiny, slightly microsculptured; all apical depressions sparsely micropunctate; sculpture on tergum VII coarser. All sterna densely uniformly micropunctate, interspaces slightly shiny. Sternum VIII with a less distinct, small obtuse tooth between two apicolateral teeth. Gonostyle with less than twenty setae on apical half; most setae equal in length. Volsella brown; characteristic (cf. Fig. 7); base of ventral setae distinctly wide; setae not in one line. Dentate apex of penis valve slightly inflexed; relatively long; with six teeth.

Coloration. Mandible apically dark red. Tegula brown translucent. Other body parts all black.

VARIABILITY OF MALES. Body length: 4.0-5.5.

Head. Glossa and galea very variable in length, approximately as long as half to more than scapus length. Labrum flat, margin variable, in most specimens rounded. Clypeal bevel variable, in most specimens as long as basomedian area; lip usually slightly pointed, arcuate in some specimens; WML:LCL = 1.2-1.5, WCL:WML = 2.2-2.4. Antennal articles III-XIII with two differently sculptured and setose areas, but less distinct than in other related species; LA3:WA3 = 1.4-1.5, LA5:WA5 = 1.5-1.6. Frons densely punctate, punctures relatively variable in size, interspaces shiny to slightly shiny. Postocellar impression on vertex distinct, relatively shallow, variable; WV:LV = 1.9-2.4.

Thorax. Scutum and scutellum with well-defined punctures two to less than one diameter apart, variable, interspaces shiny. Mesopleuron with distinct punctures on hypopleural area, punctures in most specimens one to three diameters apart, interspaces variable, in the smallest specimens almost unsculptured, shiny; in larger specimens slightly to coarsely microsculptured, slightly shiny to distinctly dull; other parts on mesopleuron relatively uniformly punctate, punctures well defined, interspaces variable, in smallest specimens shiny, in larger specimens uniformly microsculptured, dull. Forefemur with small ill-defined punctures several diameters apart, interspaces unsculptured, rarely with distinct punctures.

Gaster. Terga I-III with silvery apical bands. Gonostyle with less than twenty setae on apical half; most setae equal in length. Penis valve variable; with four to ten teeth.

GENERAL DESCRIPTION OF FEMALE. Body length: 5.5-6.5 mm.

Head. Glossa and galea very variable, approximately as long as half to more than scapus length. Labrum flat, margin variable, rounded in most specimens. Clypeus distinctly convex; basomedian area small, densely punctate, punctures well or ill defined; bevel large, often reaching base of clypeus, convex with a few large punctures, unsculptured, shiny; lip sinuate with lateral incisions; WML:LCL = 1.7-2.0, WCL:WML = 1.9-2.0. Antennae relatively short; LA3:WA3 = 2.0-2.4, LA5:WA5 = 2.2-2.5. Frons densely punctate, punctures relatively variable in size, interspaces distinct, in many specimens coarsely microsculptured, dull, or also unsculptured, shiny; frontal median line distinct. Vertex with well-developed punctures less than half to several diameters apart, interspaces more or less microsculptured, shiny, setae distinctly shorter than 1 x MOD; postocellar impression distinct, relatively shallow; WV:LV = 1.5-1.8.

Thorax. Scutum and scutellum variably sculptured, rather sparsely and irregularly punctate, but also densely uniformly punctate, punctures well defined, less than one to many diameters apart, interspaces usually sparsely microsculptured, shiny. Mesopleuron with well-defined punctures on lower and anterior part, half to one diameter apart, interspaces more or less coarsely microsculptured, slightly shiny to dull; numerous punctures of hypopleural area well defined, interspaces with more or less coarse microsculpture, dull to slightly shiny. Mesosternum with ill-defined punctures one to several diameters apart, interspaces unsculptured. Propodeal dorsum coarsely sculptured with more or less distinct longitudinal ridges, interspaces slightly shiny. Propodeal side obliquely ridged, interspaces unsculptured, shiny. Venter of mid- and hindtrochanters with a few large punctures, interspaces large, microsculptured, slightly shiny. Forefemur with variable ill-defined punctures several diameters apart, interspaces unsculptured, sometimes coarsely microsculptured; Venter of midfemur with setae distinctly shorter than 1 x MOD. Forebasitarsal rake amber, with three apical spines, separated from each other. Wings almost hyaline; veins brown.

Gaster. Terga I-III with ill-defined silvery apical bands. Terga including apical depressions microsculptured, slightly shiny, micropunctuation ill-defined or missing. Pygidial plate distinctly irregularly punctate, interspaces large, shiny, sparsely microsculptured. Central part of sternum II with several distinct large punctures, interspaces microsculptured, shiny; lateral part dull to shiny,

densely micropunctate, remaining sterna with uniform sculpture similar to that on sternum II, but more or less reduced laterally.

Coloration. Central part of mandible and apex of pygidial plate red. Tegula brown translucent. Other body parts all black.

GEOGRAPHIC DISTRIBUTION. Turkey and Jordan to Central Asia.

ETYMOLOGY. Name derived from the Latin "humilis": small, minute.

***Tachysphex karasi* sp. nov.**

(Fig. 8)

TYPE MATERIAL. **Holotype**: Turkey, **Batman**, ♂, labelled: "TURKEY / Tuzlagozu, 4.6. / (Baykan) 1998 / leg.Ma.Halada", printed label. Holotype in OLML. **Paratypes**: Bulgaria: **Burgas**: Slănčev Brjag, 18.-30.v.1989, 1 ♂, J. Halada leg., OLML; **Khaskovo**: Kharmanli env., vii.1969, 1 ♀, K. Deneš sen. leg., **Sofia**: Kresna env., 22.v.1983, 1 ♀, Z. Karas leg., ZKZC; Stara Kresna, 20.vi.1987, 1 ♀, J. Halada leg., OLML; Lebnice river valley, Sandanski env., 250 m, 2.vi.1999, 1 ♂, J. Straka leg., JSPC; Turkey: **Gaziantep**: Hasanbeyli, Osmaniye 30 km E, 10.vi.1998, 1 ♂, 1 ♀, M. Halada leg., OLML.

DIAGNOSIS. *T. karasi* sp. nov. is a member of a complex of several sibling species (see also the comment under *T. consocius* and diagnosis under *T. grandii*). *T. karasi* sp. nov. differs from *T. consocius*, *T. grandii*, *T. humilis* and *T. minutus* by a characteristic sculpture of the female mesopleuron: large punctures, distinct and well defined also on hypopleural area; mesopleuron densely punctate throughout, punctures less than one diameter apart, interspaces slightly microsculptured to unsculptured, shiny; interspaces on hypopleural area usually slightly shiny; setae on vertex and venter of midfemur shorter than 1 x MOD; antennae relatively thicker than *T. grandii* and *T. humilis* sp. nov.; mid- and hindtrochanters with small punctures one to two diameters apart; micropunctuation of terga more distinct and denser than in other related species; forefemoral notch with well-developed median longitudinal elevation with distinctly dull surface; median part sharply separated; and especially the characteristic volsella (Fig. 8).

DESCRIPTION OF HOLOTYPE. Male. Body length: 5.0 mm.

Head. Glosa and galea short, approximately as long as half of scapus length. Mandible with one inner tooth. Labrum not visible. Clypeus distinctly convex; basomedian area densely punctate; bevel shorter than basomedian area, shiny with several large punctures; lip slightly pointed. Antennae short; articles III-XIII with two differently sculptured and setose areas; article V distinctly thicker than the article XIII. Frons densely punctate with small interspaces, punctures uniform, relatively large, interspaces slightly shiny; frontal median line ill defined. Vertex with well-developed punctures less than one diameter apart, interspaces shiny; setae distinctly shorter than 1 x MOD; postocellar impression distinct, relatively shallow, obtusely V-shaped.

Thorax. Scutum and scutellum with well-defined punctures, less than half a diameter apart, interspaces shiny. Mesopleuron distinctly, densely punctate; hypopleural area with punctures one diameter or less apart, interspaces slightly shiny; other parts on mesopleuron relatively uniformly punctate, punctures well defined, also posteriorly, interspaces small, shiny. Mesosternal punctures well defined, one diameter or less apart, interspaces shiny. Propodeal dorsum finely reticulate, with ill-defined irregular longitudinal ridges, dull. Propodeal side irregularly obliquely ridged, interspaces shiny. Venter of all trochanters with small punctures about one diameter apart, interspaces slightly dull. Forefemur with small ill-defined punctures several diameters apart, interspaces unsculptured; forefemoral notch with lateral parts unsculptured, shiny; sharply separated median part microsculptured, dull. Midfemoral venter with setae distinctly shorter than 1 x MOD. Forebasitarsal rake absent. Wings almost hyaline; veins brown.

Gaster. Terga I-III with distinct silvery apical bands. Terga distinctly and densely micropunctate, interspaces slightly shiny, slightly microsculptured; all apical depressions densely micropunctate as well; punctures on tergum VII coarser and denser. All sterna densely uniformly micropunctate, interspaces slightly shiny. Sternum VIII with indistinct obtuse tooth between two apicolateral teeth. Gonostyle with five to eight setae on apical half. Volsella brown; characteristic (cf. Fig. 8); ventral setae in one line except on wider median part. Penis valve with slightly inflexed, relatively long dentate apex; with six to seven teeth.

Coloration. Mandible apically red. Tegula brown translucent. Other body parts all black.

VARIABILITY OF MALES. Body length: 5.0-6.0 mm.

Head. Glossa and galea very variable in length, approximately as long as half to more than scapus length. Mandible with one distinct inner tooth; sometimes with one very small tooth close to bigger one. Labrum flat, margin variable, usually rounded. Clypeal bevel not always shorter than basomedian area, in some specimens also longer than basomedian area; lip in most specimens slightly pointed; $WML:LCL = 1.4-1.6$, $WCL:WML = 2.1-2.3$, $LA3:WA3 = 1.4-1.6$, $LA5:WA5 = 1.2-1.5$. Frons densely punctate, sometimes with indistinct interspaces. Vertex with well-developed punctures one diameter or less apart. Postocellar impression distinct, relatively shallow, variable; $WV:LV = 1.8-2.2$.

Thorax. Scutum and scutellum with well-defined punctures less than half a diameter apart, interspaces shiny. Propodeal dorsum finely reticulate, rarely with irregular longitudinal ridges. Propodeal side variably obliquely ridged.

Gaster. Sternum VIII with more or less distinct obtuse tooth between two apicolateral teeth. Gonostyle with five to eight setae on apical half. Penis valve variable; dentate apex slightly inflexed, relatively long; with five to eight teeth.

GENERAL DESCRIPTION OF FEMALE. Body length: 5.5-6.5 mm.

Head. Glossa and galea very variable in length, approximately as long as half to more than scapus length. Labrum flat, margin variable, usually rounded. Clypeus distinctly convex; basomedian area shorter than bevel, densely punctate, punctures well defined; bevel not reaching base of clypeus, convex with a few large punctures, unsculptured, shiny; lip sinuate, with lateral incisions; $WML:LCL = 1.7-1.9$, $WCL:WML = 1.9-2.0$. Antennae relatively short; $LA3:WA3 = 1.9-2.1$, $LA5:WA5 = 2.1-2.2$. Frons densely punctate, punctures variable in size, interspaces distinct, often slightly microsculptured, shiny; frontal median line ill defined. Vertex with well-developed punctures less than half to three diameters apart, interspaces slightly microsculptured to unsculptured, shiny; setae distinctly shorter than $1 \times MOD$; postocellar impression distinct, wide, relatively shallow; $WV:LV = 1.4-1.6$.

Thorax. Scutum and scutellum variably sculptured, densely and uniformly punctate, but also sparsely and irregularly punctate, with punctures two diameters apart in central part, punctures well defined, interspaces unsculptured, shiny. Mesopleuron distinctly and densely punctate on hypoepimeral area, punctures less than one diameter apart, interspaces unsculptured to microsculptured, shiny to dull; other parts on mesopleuron almost uniformly punctate, punctures well defined, also posteriorly, interspaces unsculptured to microsculptured, shiny or slightly shiny. Mesosternum with ill-defined punctures half to two diameters apart, interspaces unsculptured. Propodeal dorsum finely reticulate, rarely with irregular longitudinal ridges, dull. Propodeal side obliquely ridged, interspaces unsculptured, shiny. Venter of mid- and hindtrochanters with small punctures one to two diameters apart, sometimes with a few large punctures, interspaces slightly shiny. Forefemur usually with small ill-defined punctures several diameters apart, interspaces unsculptured; Venter of midfemur with setae distinctly shorter than $1 \times MOD$. Forebasitarsal rake amber, with three apical spines and one preapical. Wings almost hyaline; veins brown.

Gaster. Terga I-III invariably with distinct silvery apical bands. Terga including apical depressions distinctly and densely micropunctate, interspaces slightly shiny to dull, microsculptured; except apical depression of tergum V. Pygidial plate distinctly irregularly punctate, large interspaces unsculptured, often microsculptured basally. Central part of sternum II with several distinct large punctures, interspaces microsculptured, shiny; laterally dull to shiny, densely micropunctate; remaining sterna with uniform sculpture, similar to that on sternum II, but more or less reduced laterally.

Coloration. Central part of mandible and apex of pygidial plate red. Tegula brown or reddish translucent. Other body parts all black.

GEOGRAPHIC DISTRIBUTION. Bulgaria and Turkey.

ETYMOLOGY. Named in honour of the collector of one of the paratype, Mr. Zdeněk Karas.

Tachysphex magnaemontis Hensen, 1987

Hensen & Van Ooijen 1987: 13–14, figs 1–3.

PUBLISHED RECORDS. **Bursa**: Bursa 30 km S, Uludag Mt., 1900 m, 26.viii.1985, 2 ♀♀, R. Hensen leg., (holotype and paratype) (Hensen & Van Ooijen 1987).

GEOGRAPHIC DISTRIBUTION. West Turkey (Hensen & Van Ooijen 1987).

Tachysphex melas Kohl, 1898

MATERIAL EXAMINED. **Adiyaman**: Karadut env., Nemrut dag, 9.vi.1998, 1 ♂, M. Halada leg., OLML.

GEOGRAPHIC DISTRIBUTION. Syria to Mongolia.

COMMENTS. New species for Turkey.

Tachysphex nitidior de Beaumont, 1940

Pulawski 1967: 405; 1971: 167–170, figs 92–96.

PUBLISHED RECORDS. **Çankiri**: Ilgaz, 900 m, 22.vii.1962, 1 ♀, K. M. Guichard and D. H. Harvey leg.; **Hatay**: above Antakya, 70–300 m, 15.vi.1960, 1 ♂, K. M. Guichard and D. H. Harvey leg., Antakya, 1.–7.vi.1965, 24 ♂♂, 1 ♀, J. Gusenleitner and M. Schwarz leg. (Pulawski 1967, 1971).

MATERIAL EXAMINED. **Bitlis**: Bitlis env., 1550 m, 8.vii.1996, 1 ♂, P. Tyrner leg., PTLC; **Gaziantep**: Gaziantep 30 km NW, 2001, 2 ♂♂, M. Snížek leg., JSPC; **Kayseri**: Develi 7 km NW, 1600 m, 24.vii.2003, 1 ♂, J. Straka leg., JSPC.

GEOGRAPHIC DISTRIBUTION. Southern Europe, North Africa, Near East and Central Asia.

Tachysphex nitidissimus de Beaumont, 1952

Pulawski 1967: 405; 1971: 154–158, figs 81–83.

PUBLISHED RECORDS. AYDIN, HATAY, İÇEL, KONYA, URFA (Pulawski 1967, 1971).

MATERIAL EXAMINED. **Adana**: way from Çingöz to Boztahta, Adana 45 km N, 400 m, 23.vi.2001, 1 ♂, 1 ♀, M. Fikáček, J. Hájek and J. Straka leg., Aladag (=Karsanti), Adana 85 km N, 1250 m, 15.vii.2003, 1 ♀, P. Janšta and J. Straka leg., JSPC; **Adiyaman**: Karadut env., Nemrut dag, 9.vi.1998, 1 ♀, M. Halada leg., OLML; **Antalya**: Beşkonak env., 300 m, 18.vi.2001, 1 ♂, 1 ♀, M. Fikáček, J. Hájek and J. Straka leg., JSPC; **Bitlis**: Bitlis 20 km SW, 23.vi.1997, 1 ♂, M. Halada leg., OLML; **Eskişehir**: Sakariilica naer Gümele, Eskişehir 30 km N, 6.–9.vii.1997, 1 ♀, P. Průdek and M. Říha leg., JSPC; **Hatay**: Antakya, 27.v.1996, 1 ♀, Harbiye, 17.vi.2000, 2 ♂♂, M. Halada leg., OLML; **İçel**: Ekşiler near Silifke, 27.v.1998, 1 ♀, M. Halada leg., OLML; **Kayseri**: Kapuzbaşı

env., 800 m, 16.vii.2003, 1 ♂, 2 ♀♀, Ulupinar 8 km N, Kayseri 140 km S, 1100 m, 17.vii.2003, 2 ♂♂, Hisarcik 1 km S, Kayseri 10 km S, 1660 m, 20.vii.2003, 1 ♀, P. Janšta and J. Straka leg., JSPC.

GEOGRAPHIC DISTRIBUTION. North Africa, Near East, Greece, Turkey, Iran and southern parts of Central Asia.

COMMENTS. A common species.

Tachysphex opacus F. Morawitz, 1893

PUBLISHED RECORDS. **Bitlis**: Tatvan, 1750 m, 16.viii.1985, 2 ♂♂, R. Hensen leg. (Hensen & Van Ooijen 1987).

MATERIAL EXAMINED. **Bitlis**: Ahlat env., 14.vii.1996, 1 ♂, 1 ♀, P. Tyrner and J. Vorišek leg., PTLC; **Nevşehir**: Ürgüp 10 km W, 15.vi.1998, 3 ♂♂, M. Halada leg., OLML; **Sivas**: Gürün 20 km E, 10.vii.1997, 1 ♂, M. Halada leg., OLML; **Van**: Muradiye, 2200 m, 5.vii.2000, 1 ♂, M. Halada leg., OLML.

GEOGRAPHIC DISTRIBUTION. Lebanon and Syria to Uzbekistan and China.

COMMENTS. Specimens described as dark forms of *T. pompiliformis* in Hensen & Van Ooijen (1987) most probably belong to *T. opacus*.

Males of *T. opacus* can be recognized by their slightly arcuate clypeal lip, lack conspicuous clypeal lobe corners and the lateral parts of tergum II densely punctate, with microsculptured and dull interspaces. Gaster is typically black or one to (rarely) three anterior terga can be dark red in both sexes. Females of the dark form of *T. pompiliformis* (= form "*nigripennis*") are very similar to *T. opacus* and difficult to differentiate. Males of the dark form of *T. pompiliformis* are very rarely all black.

New species for Turkey.

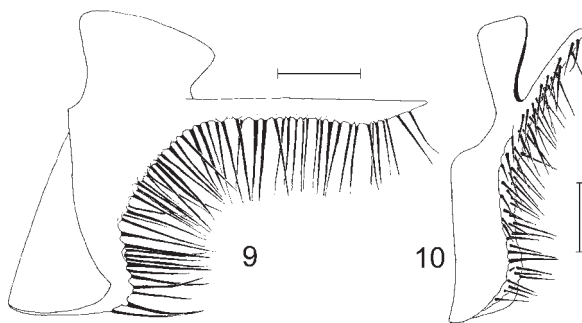
Tachysphex pompiliformis (Panzer, 1805)

(Figs 9-10)

Pulawski 1971: 62–70, figs 4–10; Hensen & Van Ooijen 1987: 16.

T. nigripennis Spinola, 1808: Pulawski 1967: 401; synonymized by Pulawski (1971).

PUBLISHED RECORDS. **Ankara**, **Antakya**, **Bolu**, **Bursa**, **Kastamonu**, **Kayseri**, **Kırşehir**, **Konya**, **Nigde**, **Sinop**, **Trabzon** (Pulawski 1967); **Agri**, **Kars** (Hensen & Van Ooijen 1987).



Figs 9, 10. *Tachysphex pompiliformis* (Panzer); 9 – volsella, outer side view, 10 – volsella, inner oblique view. Scale bar = 0.1 mm.

MATERIAL EXAMINED. **Adiyaman:** Nemrut dag, 2500 m, 13.vii.1996, 1 ♂, P. Tyrner and J. Voříšek leg., PTLC; **Ankara:** Karagol env., Ankara 50 km N, 1200 m, 22.vi.1962, 1 ♀, Kavaklidere env., 900 m, 8.viii.1960, 1 ♂, K. M. Guichard and D. H. Harvey leg., BMNH; **Bitlis:** Ahlat env., 14.vii.1996, 2 ♂♂, P. Tyrner and J. Voříšek leg., PTLC; **Kütahya:** Simav env., 800 m, 1.viii.1962, 1 ♀, K. M. Guichard and D. H. Harvey leg., BMNH; **Erzurum:** Tekederesi env., Erzurum 15 km SW, 2300 m, 2.vii.2001, 2 ♂♂, 2 ♀♀, M. Fikáček, J. Hájek and J. Straka leg., JSPC.

GEOGRAPHIC DISTRIBUTION. Holarctic region.

COMMENTS. A common species. See the comment under *T. opacus* for the specimens listed in Hensen & Van Ooijen (1987) as a dark *T. pompiliformis*.

Tachysphex prismaticus sp. nov.

(Figs 11-15)

TYPE MATERIAL. **Holotype:** Kazakhstan, ♂, labelled: "Kazakhstan 20km / SE Aksay env / 16. - 19. 6. 1992 / leg.K.Denes", printed label. Holotype in OLML. **Paratypes:** Kazakhstan: Aksay 20 km SE, 16.-19.vi.1992, 2 ♀♀, K. Deneš sen. leg., 7 ♂♂, J. Halada leg., OLML, JSPC; Senek 10 km E, Zhangaözen 50 km E, v.2000, 1 ♀, J. Miatleuski leg., OLML; Kyrgyzstan: Tash-Aryk 11 km E Talas, 4.vii.1992, 1 ♂, M. Halada leg., 1 ♂, Jirousek leg., OLML; Turkey: **Van:** Muradiye 40 km NE, 2200 m, 5.vii.2000, 1 ♂, M. Halada leg., OLML.

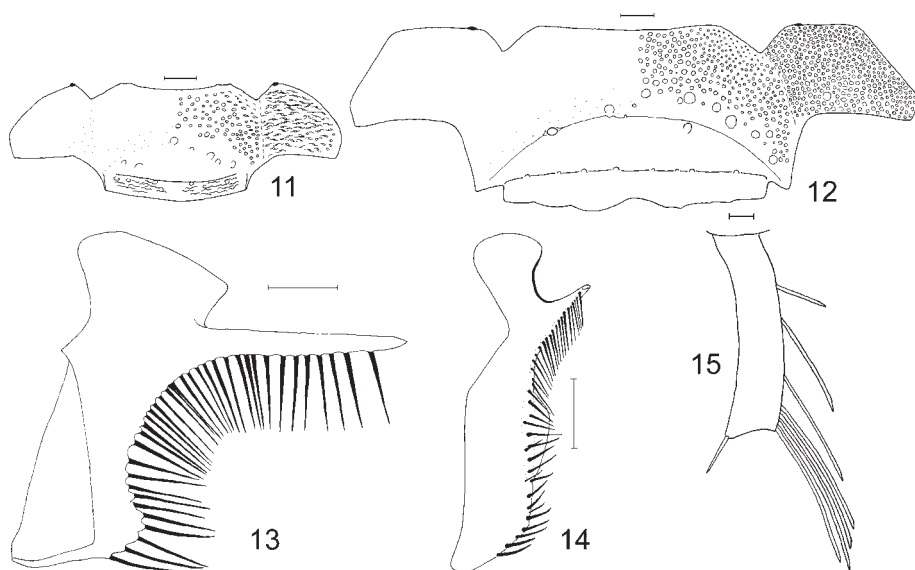
ADDITIONAL MATERIAL EXAMINED. Kyrgyzstan: **Dzahal-Abad:** Tschatkal-Tal NW Tschakmak-Suu, 2200 m, 8.-9.vii.1998, 1 ♂, H. and R. Rausch leg.; Dzahal-Abad, vi.2000, 1 ♂, V. Gurko leg., JSPC; Orto-Tokoy, vii.1998, 1 ♀, V. Gurko leg., OLML.

DIAGNOSIS. *Tachysphex prismaticus* is a member of *T. pompiliformis* species complex. This species complex is defined in the following combination of characters. ♂, ♀: glossa and galea distinctly shorter than scapus; sculpture on mesopleuron dull, slightly punctate, or impunctate, or rugose; gaster with more or less distinct silver apical bands of tergum I-III (at least in some specimens of the species silver, in some specimens not silver); ♂: forebasitarsus without well-developed rake; ♀: clypeal bevel not reaching clypeal base; clypeal lip with lateral incisions and more or less distinct median emargination (distinct in fresh specimens); fore- and midfemoral venter sculptured as fine as laterally (only in some specimens with a few large, ill-defined punctures). *T. prismaticus* resembles *T. austriacus* Kohl, 1892, *T. pompiliformis*, *T. opacus*, *T. ferrugineus*, *T. kaszabi* Tsuneki, 1972 and *T. pekingensis* Tsuneki, 1971. It differs from these species in the following combination of characters: ♂, ♀: mesopleuron rugose to densely punctate; venter of all trochanters with punctures several diameters apart, their interspaces unsculptured; all femora and tibiae all black; ♂: volsella characteristic (Fig. 13); ventral volsellar setae in one line (Fig. 14), compare with volsella of *T. pompiliformis* (Figs 9 and 10); ♀: clypeal lip with distinct irregular median emargination (Fig. 12); relatively sharp and more or less angulated transition between clypeal basomedian area and bevel; forebasitarsal rake with four apical spines (Fig. 15).

DESCRIPTION OF HOLOTYPE. Male. Body length: 7.0 mm.

Head. Mandible with one distinct inner tooth. Labrum flat, emarginated to a heart-shape. Clypeus (cf. Fig. 11) slightly convex; basomedian area slightly convex, more or less densely punctate; bevel abrupt, as long as basomedian area, shiny, with a few large punctures; lip arcuate. Antennae relatively short. Frons and vertex densely, uniformly punctate, punctures usually less than one diameter apart, interspaces slightly shiny; setae shorter than MOD, erect to nearly erect.

Thorax. Scutum and scutellum densely, uniformly punctate, punctures less than one diameter apart, interspaces shiny. Mesopleuron rugose; hypoepimeral area and mesopleuron posteriorly irregularly obliquely ridged; remainder densely punctatorugose. Mesosternum densely punctate. Propodeal dorsum rugose, similar to mesopleuron. Propodeal side obliquely ridged. Venter of all trochanters with punctures several diameters apart; interspaces on foretrochanter unsculptured or slightly microsculptured. Forefemoral notch small, semicircular, but relatively deep and well defined, with shiny surface. Wings slightly yellowish; veins brown.



Figs 11–15. *Tachysphex prismaticus* sp. nov.; 11 – male clypeus, 12 – female clypeus, 13 – volsella, outer side view, 14 – volsella, inner oblique view, 15 – female forebasitarsus; scale bar = 0.1 mm.

Gaster. Terga I–III with distinct silvery apical bands; apical depressions on all terga slightly translucent, well defined especially on tergum I. Tergal punctures ill defined, evanescent in micro-sculpture; also apical depressions with punctures, but less distinct on terga I–II. All sterna with uniform sculpture similar to that on terga, but punctures more distinct. Gonostyle with less than 20 setae on apical half; setae not shortened continuously towards apex. Volsella characteristic (cf. Fig. 13); ventral setae on volsella in one line (cf. Fig. 14).

Coloration. Apical half of mandible and distal parts of tarsi red. Apical depression on gastral segment I and major parts of tegula reddish translucent. Other body parts all black.

VARIABILITY OF MALES. Body length: 5.5–8.0 mm.

Head. Lip arcuate or biarcuate; $WML:LCL = 1.1-1.3$; $WCL:WML = 2.2-2.6$. Antennae relatively short; $LA3:WA3 = 1.7-2.0$; $LA5:WA5 = 2.1-2.4$. Frons and vertex densely and uniformly punctate, punctures less than one diameter apart, interspaces shiny to slightly dull; $WV:LV = 1.3-1.4$.

Thorax. Scutum and scutellum densely, uniformly punctate, punctures less than one diameter apart, interspaces shiny or slightly shiny. Mesopleuron rugose to densely punctate; hypopleural area and posterior part on mesopleuron often irregularly obliquely ridged; remainder densely punctatorugose. Propodeal dorsum rugose, often with more or less irregular longitudinal ridges. Wings almost hyaline to slightly yellowish; veins brown.

Gaster. Apical depressions on all terga more or less translucent; especially tergum I in the all black form. Gonostyle with less than 20 setae on apical half; setae not shortened continuously towards apex.

Coloration. Gastral segment I sometimes with a narrow red band close to the apical depression. Gastral segments I–III and I–IV red in two specimens from Dzahal-Abad province, Kyrgyzstan.

GENERAL DESCRIPTION OF FEMALE. Body length: 7.5–8.5 mm.

Head. Labrum flat, emarginated to a heart-shape. Clypeal lip with irregular median emargination (Fig. 12); transition between clypeal basomedian area and bevel relatively sharp, angulated; basomedian area as long as bevel or shorter; bevel shiny; WML:LCL = 1.7, WCL:WML = 1.8. Antennae relatively short; LA3:WA3 = 2.6-2.8; LA5:WA5 = 3.0-3.2. Frons and vertex densely, uniformly punctate, punctures less than one diameter apart, interspaces larger on vertex along compound eyes, interspaces shiny; setae short, erect to nearly erect; postocellar impression distinct, rectangular; WV:LV = 1.1-1.3. Malar space and adjacent part of gena almost impunctate, integument bright shiny; gena densely punctate.

Thorax. Scutum and scutellum unevenly punctate, punctures in the middle half to three diameters apart (individually variable), interspaces shiny. Mesopleuron rugose to densely punctate; hypoepimeral area and mesopleuron posteriorly often irregularly obliquely ridged; remainder densely punctatorugose. Mesosternum densely punctate. Propodeal dorsum rugose, in most specimens with more or less irregular longitudinal ridges. Propodeal side obliquely ridged. Venter of all trochanters with punctures several diameters apart; interspaces on trochanter I unsculptured or slightly microsculptured. Forebasitarsal rake with four or five apical spines (Fig. 15). Wings almost hyaline to slightly yellowish; veins brown.

Gaster. Terga I-III with distinct silvery apical bands; apical part of all terga slightly translucent. Tergal punctures ill defined, evanescent in microsculpture; also apical depressions with punctures, but less distinct; terga slightly shiny to dull. Sterna finely microsculptured, slightly shiny to dull, punctures in some specimens distinct. Pygidial plate variable.

Coloration. Median part of mandible; two or three distal tarsal segments and gastral segments I-II or I-III red. Posterior half of tegula reddish translucent. Other body parts all black.

GEOGRAPHIC DISTRIBUTION. Turkey, Kyrgyzstan and Kazakhstan.

ETYMOLOGY. Derived from the Latin “prisma”, meaning a prism, referring to the shape of the clypeus in females.

Tachysphex psammobius (Kohl, 1880)

Pulawski 1967: 405, figs 26–27; 1971: 96–99, figs 26–28; Hensen & Van Ooijen 1987: 16.

PUBLISHED RECORDS. **Amasya**, **Ankara**, **Antalya**, **Bilecik**, **Çorum**, **Hatay**, **Içel**, **Konya**, **Mugla**, **Trabzon**, **Urfa** (Pulawski 1967, 1971).

MATERIAL EXAMINED. **Antalya**: Taşkesigi, Antalya 100 km E, 1998, 1 ♂, M. Halada leg., OLML; **Erzurum**: Tekederesi env., Erzurum 15 km SW, 2300 m, 2.vii.2001, 2 ♂♂, 3 ♀♀, M. Fikáček, J. Hájek and J. Straka leg., JSPC.

GEOGRAPHIC DISTRIBUTION. Western and Northern Europe to Central Asia.

Comments. A common species.

Tachysphex punctipes Pulawski, 1967 (Figs 16-19)

Pulawski, 1967: 404.

TYPE MATERIAL EXAMINED. **Holotype**: Turkey: **Artvin**: 20 km from Yusufeli on Yusufeli – Tortum road, 700 m, 8.vi.1962, 1 ♀, K. M. Guichard and D. H. Harvey leg., BMNH.

ADDITIONAL MATERIAL EXAMINED. Kazakhstan: Matay desert, 23.-25.vi.1995, 1 ♀, M. Múčka leg., OLML; Mongolia: Bayanzag, Dalanzadgad 100 km SW, Gobi desert, biotop with *Saxaulus* sp., 1.-2.vii.2003, 5 ♂♂, 1 ♀, J. Halada leg., OLML, JSPC; Turkey: **Van**: Erciş 10 km E, 25.vi.1997, 1 ♀, M. Halada leg., OLML.

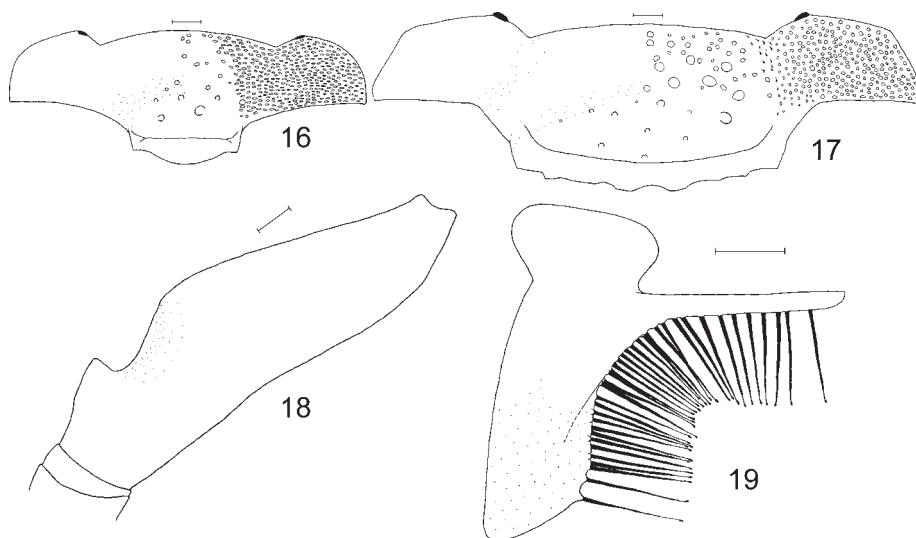
DIAGNOSIS. *Tachysphex punctipes* is member of *T. mongolicus* species complex. For list of related species and definition of this complex see diagnosis under *T. bouceki* sp. nov. *T. punctipes* differs from related species in the following combination of characters: forefemur largely lacking punctures,

shiny, (especially in ♀); body all black; rugose to punctatorugose mesopleuron, hypoepimeral area ridged; terga I-III with distinct silvery apical bands; clypeus and central part of scutum sparsely punctate and forebasitarsal rake developed in male. For some other characters, see figs 16-19.

GENERAL DESCRIPTION OF MALE. Body length: 6.5-8.0 mm.

Head. Mandible with one small tooth. Labrum incurved medially; margin rounded. Clypeus (Fig. 16) convex; basomedian area developed only on side, superficially but distinctly punctate; bevel reaching base of clypeus, shiny, with a few deep, large punctures several diameters apart; lip arcuate, relatively long; setae conceal integument; $WML:LCL = 0.9$; $WCL:WML = 3.0-3.3$. Antennae relatively short; $LA3:WA3 = 1.8-2.0 (-2.2)$; $LA5:WA5 = 1.9-2.5$. Frons with relatively shallow punctures less than half to one diameter apart; median line distinct, lacking punctures. Vertex uniformly punctate, punctures one to three diameters apart, smaller than on the frons, interspaces shiny to slightly dull, more or less microsculptured; setae erect, about $1 \times MOD$ long; $WV:LV = 1.3-1.5$.

Thorax. Scutum sparsely punctate towards its centre, punctures there one to two diameters apart; less than one diameter apart on side, interspaces shiny with shallow microsculpture; scutal setae inclined posterad in anterior part, inclined anterad in posterior part, about $1-3 \times MOD$ long. Scutellum regularly punctate, as on the central part of scutum. Mesopleuron rugose to shallowly punctate, punctures distinct, interspaces rugose to rugosely microsculptured, depending on body size; hypoepimeral area and posterior part on mesopleuron in large specimens linearly ridged between punctures; in small specimens with flat shiny interspaces. Mesosternal punctures variable, about one diameter apart in small specimens to less than half a diameter apart in large specimens, interspaces shiny to dull. Propodeal dorsum rugose, in most specimens with more or less irregular longitudinal ridges; setae inclined anterad, about $1.5 \times MOD$ long. Propodeal side obliquely ridged, interspaces shiny, without microsculpture. Venter of all trochanters with a few



Figs 16-19. *Tachysphex punctipes* Pulawski; 16 - male clypeus, 17 - female clypeus, 18 - male forefemur, lateral view, 19 - volsella, inner side view; scale bar = 0.1 mm.

punctures, their interspaces unsculptured. Forefemur thin; punctures small, several diameters apart, interspaces unsculptured; forefemoral notch large (Fig. 18), surface dull, with microscopical pubescence. Other femora more densely sculptured, more or less dull; Venter unsculptured. Forebasitarsal rake developed, with three to five long spines; apical spine as long as the following tarsomere; tarsomeres II and III with apical spine as long as or longer than the following tarsomere. Wings almost hyaline; veins brown.

Gaster. Terga I-III with well-developed silvery apical bands. Tergal punctures evanescent in dense microsculpture; apical depressions with punctures, punctation relatively dense, interspaces dull; sculpture on tergum VII sparser, interspaces shiny. Central part of sternum II with small punctures intermixed with large one, interspaces shiny, but gradually becoming dull laterally and basally; remaining sterna with uniform sculpture similar to that on sternum II. Sternum VIII with small obtuse tooth between two apicolateral teeth. Gonostyle with fewer than 25 setae equal in length on apical half. Volsella dark brown; characteristic (Fig. 19); base of ventral setae narrow, parallel; setae almost in one line. Penis valve with five distinct teeth, sometimes with one additional indistinct apical tooth.

Coloration. Central part of mandible, several apical tarsomeres and tegula more or less reddish. Other body parts all black.

GENERAL DESCRIPTION OF FEMALE. Body length: 8.5-9.5 mm.

Head. Labrum incurved medially; margin rounded. Clypeus (Fig. 17) distinctly convex; basomedian area hardly recognizable, developed only on side, superficially punctate; bevel reaching base of clypeus, shiny, with a few deep very large punctures, several diameters apart; lip with lateral incisions and a median emargination; $WML:LCL = 1.5-1.7$; $WCL:WML = 2.0-2.1$. Antennae relatively short; $LA3:WA3 = 2.7-2.8$; $LA5:WA5 = 2.6-2.9$. Frons with distinct punctures about one diameter apart, interspaces slightly dull; median line deep, impunctate. Vertex slightly impressed, uniformly punctate, punctures half to one diameter apart, interspaces shiny or slightly dull; setae erect, about 1 x MOD long; $WV:LV = 1.2-1.4$.

Thorax. Scutum sparsely punctate towards centre, punctures there several diameters apart; less than one diameter apart laterally, interspaces shiny with or without shallow microsculpture; scutal setae inclined posterad in anterior part, inclined anterad in posterior part, about 1.5-3 x MOD long. Scutellum punctate, as on the central part of scutum. Mesopleuron rugose to distinctly punctate, punctures distinct on lower part, interspaces rugose, linear to rugosely microsculptured; hypopleural area and posterior part on mesopleuron with linear interspaces. Mesosternal punctures one to two diameters apart, interspaces shiny, unsculptured. Propodeal dorsum irregularly rugose or with more or less irregular longitudinal ridges; setae inclined anterad, about 2 x MOD long. Propodeal side obliquely ridged, interspaces shiny, without distinct microsculpture. Venter of all trochanters with a few punctures, their interspaces unsculptured. Forefemur thin, shiny, small punctures (if developed) several diameters apart, interspaces unsculptured; Venter with several large punctures, interspaces unsculptured; $LF1:WF1 = 3.2-3.6$. Other femora more densely sculptured, more or less dull; venter almost unsculptured, with several large punctures only. Forebasitarsal rake light brown, with three or four long apical spines and in most specimens with one preapical spine close to the other apical spines. Wings almost hyaline; veins brown.

Gaster. Terga I-III with well-developed silvery apical bands. Tergal punctures evanescent in dense microsculpture; also apical depressions with punctures, punctation relatively dense, interspaces dull; sculpture on tergum V with sparser punctures; apical depression impunctate, interspaces slightly shiny. Pygidial plate variable, punctures several diameters apart, interspaces microsculptured or unsculptured. Central part of sternum II with several distinct punctures,

interspaces microsculptured, shiny; lateral part dull, densely micropunctate; remaining sterna with uniform sculpture similar to that on sternum II, but more or less reduced laterally.

Coloration. Central part of mandible, last two tarsomeres, posterior half of tegula, apex of tergum and sternum VI more or less reddish. Other body parts all black.

GEOGRAPHIC DISTRIBUTION. Turkey, Kazakhstan, Mongolia.

COMMENTS. Previously known only from the holotype. This is the first description of the male and an improved description of the female based on additional specimens.

Tachysphex stachi de Beaumont, 1936

MATERIAL EXAMINED. **Adiyaman**: Karadut env., Nemrut dag, 9.vi.1998, 1 ♂, M. Halada leg., OLML; **Van**: Muradiye env., Van 120 km NE, 2000 m, 5.vi.2001, 1 ♂, K. Deneš sen. leg., OLML.

GEOGRAPHIC DISTRIBUTION. Israel and southern Russia (European part) to Central Asia.

COMMENTS. New species for Turkey.

Tachysphex subdentatus F. Morawitz, 1893

Pulawski 1967: 405, figs 26–27; 1971: 96–99, figs 26–28; Hensen & Van Ooijen 1987: 16.

PUBLISHED RECORDS. **Konya**: Konya env., 25.-27.v. and 15.vi.1965, 4 ♂♂, J. Gusenleitner and M. Schwarz leg.; Nigde: Çiftehan env., 1000 m, 23.vi.1962, 1 ♂, K. M. Guichard and D. H. Harvey (Pulawski 1967); **Afyon**, without details (Pulawski 1971); **Antalya**: Demirtaş, 100 m, 29.vii.1985, 1 ♂, R. Hensen leg.; **Bingöl**: Genç 15 km S, 1400 m, 13.viii.1985, 1 ♀, R. Hensen leg. (Hensen & Van Ooijen 1987).

MATERIAL EXAMINED. **Agri**: Agri 20 km S, 1600 m, 17.viii.1991, 1 ♀, M. Halada leg., OLML.

GEOGRAPHIC DISTRIBUTION. Greece to Central Asia.

Tachysphex tarsinus Lepeletier, 1845

Pulawski 1967: 405; 1971: 158–161, figs 84–88.

PUBLISHED RECORDS. **Samsun**: Samsun env., 0–30 m, 2.viii.1959, 1 ♀, K. M. Guichard and D. H. Harvey leg. (Pulawski 1967, 1971).

MATERIAL EXAMINED. **Adana**: Karaömerli env., Seyhan Barajı, 80 m, 21.vi.2001, 1 ♂, way from Çingöz to Boztahta, Adana 45 km N, 400 m, 23.vi.2001, 1 ♀, M. Fikáček, J. Hájek and J. Straka leg., JSPC; **Kayseri**: Kapuzbaşı env., 800 m, 16.vii.2003, 1 ♀, Ulupinar 12 km N, Kayseri 140 km S, 1300 m, 17.vii.2003, 1 ♀, P. Janšta and J. Straka leg., JSPC.

GEOGRAPHIC DISTRIBUTION. Europe, North Africa, Turkey, Kazakhstan and China.

Tachysphex unicolor Panzer, 1809

as *T. nitidus* Spinola, 1805. Pulawski 1967: 405; 1971: 139–146, figs 75–78.

PUBLISHED RECORDS. **Ankara**: above Hasanoglan, 1500 m, 29.vi.1962, 1 ♀, K. M. Guichard and D. H. Harvey leg.; **Istanbul**: Şile, 16.ix.1911, 1 ♀, Náday leg.; **Kayseri**: Erciyes dagı, 1800 m, 14.vi.1962, 1 ♀, K. M. Guichard and D. H. Harvey leg.; **Kütahya**: Gediz env., 824 m, 29.vii.1962, 1 ♀, K. M. Guichard and D. H. Harvey leg. (Pulawski 1967); **Hatay**, **İçel**, **Konya**, **Urfa**, without details (Pulawski 1971).

MATERIAL EXAMINED. **Adiyaman**: Karadut env., Nemrut dag, 9.vi.1998, 1 ♂, M. Halada leg., OLML; **Antalya**: Akseki env., 19.vi.1998, 2 ♂♂, 1 ♀, M. Halada, OLML; **Gaziantep**: Gaziantep 30 km W, 30.v.1998, 1 ♀, M. Halada leg., OLML; **İçel**: Uzuncaburç, Silifke 30 km N, 28.v.1996, 1 ♀, Kirobasi, Mut 40 km E, Çörnelek, 29.v.1996, 1 ♂, Mut 60 km E, 19.vi.1997, 2 ♂♂, Erdemli 30 km N, 17.vi.1998, 2 ♂♂, M. Halada leg., OLML; **Kahraman Maras**: Kahramanmaraş 40 km SE, 10.vi.1998, 2 ♂♂, M. Halada leg., OLML; **Kayseri**: Çamlıca 5 km SW, Kayseri 120 km

S, 1700 m, 18.vii.2003, 3 ♂♂, P. Janšta and J. Straka leg., Develi 7 km NW, 1600 m, 24.vii.2003, 2 ♂♂, J. Straka leg., JSPC; **Konya**: Seydişehir, 1800 m, 4.viii.1991, 1 ♀, M. Halada leg., OLML; **Urfa**: Halfeti env., 3.-5.v.1994, 2 ♂♂, Mi. Halada leg., OLML.

GEOGRAPHIC DISTRIBUTION. Palearctic region.

COMMENTS. This very variable species may be a complex of several sibling taxa. There are two main morphotypes in Europe, one in Central Europe and highland regions of southern Europe, the other in the lowlands of southern Europe. Some other morphotypes occur in North Africa and Near East.

Tachysphex euxinus species group

***Tachysphex euxinus* Pulawski, 1958**

Pulawski 1967: 401; 1971: 199–202, figs 128–132.

PUBLISHED RECORDS. **Istanbul**: Beykoz, 1 ♀, E. Horvath leg., **Bursa**, **Kütahya** (Pulawski 1967, 1971).

MATERIAL EXAMINED. **Bursa**: Çaglıyan env., 10.-14.vii.1997, 1 ♂, P. Průdek and M. Říha leg., JSPC; Karacabey 10 km S, 10 m, 3.viii.1962, 1 ♂, K. M. Guichard and D. H. Harvey leg., BMNH; **Kütahya**: Simav, 800 m, 1.viii.1926, 1 ♀, K. M. Guichard and D. H. Harvey leg., BMNH.

GEOGRAPHIC DISTRIBUTION. Bulgaria, Turkey, Syria and Lebanon.

Incertae sedis (intermediate between *T. brullii* and *T. pompiliiformis* species groups)

***Tachysphex pusulosus* de Beaumont, 1955**

Pulawski 1971: 136–138, figs 70–74.

PUBLISHED RECORDS. **Urfa**: Birecik, without details (Pulawski 1971).

GEOGRAPHIC DISTRIBUTION. North Africa and Near East.

COMMENTS. The form of the male volsella and female forebasitarsal rake indicate a close relationship to the *Tachysphex brullii* species group.

Tachysphex brullii species group

***Tachysphex brullii brullii* (F. Smith, 1856)**

as *T. bicolor bicolor* Brullé, 1833. Pulawski 1967: 400; 1971: 203–209, figs 133–143.

PUBLISHED RECORDS. **Amasya**, **Ankara**, **Çorum**, **Erzurum**, **Konya**, **Mugla**, **Nigde**, **Sivas** (Pulawski 1967).

MATERIAL EXAMINED. **Erzurum**: Tekederesi env., Erzurum 15 km SW, 2300 m, 2.vii.2001, 1 ♂, 1 ♀, M. Fikáček, J. Hájek and J. Straka leg., JSPC; “Tayallar” (not located), 9.v.1984, 1 ♂, I. Rozner leg., HNHM.

GEOGRAPHIC DISTRIBUTION. South and Central Europe, Turkey and Central Asia.

COMMENTS. A common species. Some of them could however belong to ssp. *galileus* (Pulawski 1967). The occurrence in Central Asia (Pulawski 1971) needs confirmation.

***Tachysphex brullii galileus* de Beaumont, 1947**

as *T. bicolor galileus* de Beaumont, 1947. Pulawski 1967: 401; 1971: 209–210.

PUBLISHED RECORDS. **Erzurum**: İspir, 1299 m, 31.v.1962, 1 ♀, K. M. Guichard and D. H. Harvey leg.; **Hatay**: Antakya, 1.-7.vi.1965, 1 ♂, 2 ♀♀, J. Gusenleitner and M. Schwarz leg.; **Içel**: Tarsus, 29.-31.v.1965, 1 ♀, J.

Gusenleitner and M. Schwarz leg.; **Konya**: Beyşehir, 4.-6.vi.1964, 2 ♂♂, 1 ♀, J. Gusenleitner and M. Schwarz leg. (Pulawski 1967, 1971).

MATERIAL EXAMINED. **Kütahya**: Kütahya 30 km N, 13.vi.2000, 1 ♀, M. Halada leg., OLML.

GEOGRAPHIC DISTRIBUTION. Turkey, Israel and Jordan.

COMMENTS. The status of *T. brullii galileus* needs re-evaluation based on abundant material.

Tachysphex coriaceus (A. Costa, 1867)

MATERIAL EXAMINED. **Bursa**: Çaglıyan env., 10.-14.vii.1997, 1 ♂, P. Průdek and M. Říha leg., 20.-23.vii.1998, 1 ♀, M. Říha leg., JSPC.

GEOGRAPHIC DISTRIBUTION. Bosnia-Herzegovina, Italy, Slovakia; recorded also from Spain (Bitsch et al. 2001).

COMMENTS. The female examined has a black gaster. New species for Turkey.

Tachysphex graecus Kohl, 1883

Pulawski 1967: 401; 1971: 216–219, figs 153–160.

PUBLISHED RECORDS. **Kirikkale**: Kirikkale 13 km W, 900 m, 30.vi.1960, 11 ♂♂, 3 ♀♀, K. M. Guichard and D. H. Harvey leg. (Pulawski 1967); **Denizli, Istanbul**, without details (Pulawski 1971).

MATERIAL EXAMINED. **Antalya**: Göynük env., Antalya 25 km SW, 18.-20.vii.2002, 1 ♀, P. Tyrner leg., PTLC; **Eskişehir**: Sakariilica naer Gümele, Eskişehir 30 km N, 6.-9.vii.1997, 16 ♂♂, 4 ♀♀, P. Průdek and M. Říha leg., JSPC, MRBC, PTLC; **Içel**: Büyükeçeli (Ovaçık) env., 14.-18.vii.1998, 1 ♀, J. Bezděk, MRBC.

GEOGRAPHIC DISTRIBUTION. Macedonia and Bulgaria to Lebanon and Israel.

Tachysphex latifrons Kohl, 1884

Pulawski 1967: 400; 1971: 203–209, figs 133–143.

PUBLISHED RECORDS. **Ankara**: Elma Dagı, 1800 m, 21.v.1960, 2 ♂♂, K. M. Guichard and D. H. Harvey leg.; **Çorum**: Iskilip, 700 m, 9.v.1962, 1 ♀, K. M. Guichard and D. H. Harvey leg.; **Erzurum**: 14-20 km from Ispir on Ispir – İkizdere road, 2.vi.1962, 3 ♀♀, K. M. Guichard and D. H. Harvey leg.; **Eskişehir**: Sivrihisar, 28.v.1964, 2 ♀♀, J. Gusenleitner and M. Schwarz leg.; **Giresun**: Balaban Dagları, 1600 m, 9.vii.1960, 1 ♀, K. M. Guichard and D. H. Harvey leg.; **Hatay**: 2 ♂♂, 2 ♀♀, K. M. Guichard and D. H. Harvey leg., details not indicated, mistake in reference, **Samsun**: Havsa, 500 m, 19.v.1959, 1 ♂, K. M. Guichard and D. H. Harvey leg. (Pulawski 1967, 1971); **Antalya**: between Finike and Kaş, without details (Pulawski 1971).

MATERIAL EXAMINED. **Adıyaman**: Karadut env., Nemrut dag, 9.vi.1998, 1 ♀, M. Halada leg., OLML; **Antalya**: Akseki 10 km N, 24.v.1998, 1 ♂, M. Halada, OLML; **Bursa**: “Brussa”, 1884, 1 ♀ (holotype), NHMW.

GEOGRAPHIC DISTRIBUTION. Greece and Libya to Central Asia.

Tachysphex obscuripennis (Schenck, 1857)

Pulawski 1971: 223–228, figs 165–172.

PUBLISHED RECORDS. **Ankara**, without details (Pulawski 1971).

MATERIAL EXAMINED. **Erzincan**: Refahiye 15 km W, 1600 m, 7.vii.2000, 1 ♂, M. Halada leg., OLML; **Sivas**: Gürün 20 km E, 10.vii.1997, 1 ♂, M. Halada leg., OLML.

GEOGRAPHIC DISTRIBUTION. Whole of Europe, Turkey and Lebanon.

Tachysphex picnic Van Ooijen, 1987

Hensen & Van Ooijen 1987: 15–16, figs 4–6.

PUBLISHED RECORDS. **Bursa**: Bursa, Uludag, 5.ix.1983, 1 ♀, P. v. Ooijen leg. (holotype), Bursa 30 km S, Uludag Mt., 1900 m, 26.viii.1985, 1 ♀, R. Hensen leg. (paratype) (Hensen & Van Ooijen 1987).

GEOGRAPHIC DISTRIBUTION. West Turkey (Hensen & Van Ooijen 1987).

Tachysphex brevipennis species group

Tachysphex minutus Nurse, 1909 sensu Krombein & Pulawski 1994

as *T. rhodius* de Beaumont, 1960. Pulawski 1967: 408.

as *T. sp. aff. rhodius* de Beaumont, 1960. Pulawski 1967: 408.

T. rugosus Gussakovskij, 1952. Pulawski 1971: 243–245, figs 190–191, synonymized by Pulawski in Krombein & Pulawski (1994).

PUBLISHED RECORDS. **Hatay**: Antakya, 1-7.vi.1965, 2 ♂♂, 2 ♀♀, J. Gusenleitner and M. Schwarz leg.; **Içel**: Mut, 9.-13.vi.1965, 2 ♀♀, Tarsus, 29.-31.v.1965, 1 ♂, ♀, J. Gusenleitner and M. Schwarz leg. (Pulawski 1967, 1971); **Istanbul**, **Konya**, without details (Pulawski 1971).

MATERIAL EXAMINED. **Hatay**: Antakya, 27.v.1996, 1 ♀, M. Halada leg., OLML.

GEOGRAPHIC DISTRIBUTION. Southeastern Europe, Sicily, whole of Africa, Near East, Central Asia and India.

COMMENTS. *T. minutus* is an heterogeneous species, probably a conglomerate of many closely related taxa. The specimen examined had two red anterior gastral segments and mainly reddish legs.

Tachysphex plicosus species group

Tachysphex mediterraneus Kohl, 1883

Pulawski 1967: 401; 1971: 255–258, figs 199–204.

PUBLISHED RECORDS. **Adana**: Çalidagi, 100 m, 27.v.1960, 1 ♂, K. M. Guichard and D. H. Harvey leg.; **Içel**: Mut, 9.-13.vi.1965, 1 ♀, J. Gusenleitner and M. Schwarz leg.; **Istanbul**: Şile, 11.vii.1962, 1 ♂, K. M. Guichard and D. H. Harvey leg. (Pulawski 1967, 1971); **Denizli**: Çamlık, without details (Pulawski 1971);

MATERIAL EXAMINED. **Adana**: way from Çingöz to Boztahta, Adana 45 km N, 400 m, 23.vi.2001, 1 ♀, 1 ♂, M. Fikáček, J. Hájek and J. Straka leg., Karataş 5-8 km W, Adana 48 km S, 30 m, 16.vii.2003, 3 ♂♂, P. Janšta and J. Straka leg., JSPC; **Bursa**: Kurşunlu env., 15.-17.vii.1997, 1 ♂, P. Průdek and M. Říha leg. MRBC; **Kayseri**: Develi 7 km NW, 1600 m, 24.vii.2003, 1 ♂, J. Straka leg., JSPC.

GEOGRAPHIC DISTRIBUTION. Southern Europe, Africa south to Zaire and Zambia, Near East, Central Asia, India and Sri Lanka.

Tachysphex plicosus (A. Costa, 1867)

Pulawski 1971: 258–260, figs 205–210; Hensen & Van Ooijen 1987: 16.

PUBLISHED RECORDS. **Urfa**: Urfa, without details (Pulawski 1971); **Antalya**: Demirtaş, 100 m, 29.vii.1985, 1 ♂, 1 ♀, R. Hensen leg. (Hensen & Van Ooijen 1987).

GEOGRAPHIC DISTRIBUTION. Europe north to southern France and Romania, Africa south to Cape Province, Turkey, India, Sri Lanka and Thailand; recorded also from Hungary (Zsolt 2002).

Tachysphex panzeri species group

***Tachysphex incertus* (Radoszkowski, 1877)**

Pulawski 1967: 397; 1971: 318–322, figs 273–278.

PUBLISHED RECORDS. **Amasya, Hatay, İçel, Istanbul, Kahraman Maras, Konya, Urfa** (Pulawski 1967, 1971).

MATERIAL EXAMINED. **Adana:** Çiçekli, Adana 25 km N, 3.-5.vii.1998, 1 ♂, M. Říha leg., JSPC, Karaömerli env., Seyhan Barajı, 80 m, 22.vi.2001, 1 ♂, way from Çingöz to Boztahta, Adana 45 km N, 400 m, 23.vi.2001, 1 ♂, Boztahta 10 km W, Adana 45 km NNE, 300 m, 26.vi.2001, 1 ♂, M. Fikáček, J. Hájek and J. Straka leg., JSPC; **Antalya:** Gebiz env., 8.vii.2000, 2 ♂♂, J. Straka leg., JSPC, Side env., Antalya 70 km E, 29.vii.-7.viii.2001, 2 ♂♂, P. Tyrner leg., PTLC; **Bitlis:** Ahlat env., 14.vii.1996, 1 ♂, 2 ♀♀, P. Tyrner and J. Voříšek leg., PTLC; **Bursa:** Çağliyan env., 10.-14.vii.1997, 2 ♀♀, Kurşunlu env., 15.-17.vii.1997, 1 ♀, P. Průdek and M. Říha leg., MRBC; **Erzurum:** İlica 1 km S, Erzurum 15 km NWW, 1950 m, 30.vi.2001, 1 ♂, Tekederesi env., Erzurum 15 km SW, 2300 m, 2.vii.2001, 3 ♂♂, M. Fikáček, J. Hájek and J. Straka leg., JSPC; **Eskişehir:** Sakariilica naer Gümele, Eskişehir 30 km N, 6.-9.vii.1997, 2 ♂♂, P. Průdek and M. Říha leg., MRBC; **Gaziantep:** Hasanbeyli, Nur Dagları, 1150 m, 16.vii.1996, 1 ♂, P. Tyrner and J. Voříšek leg., PTLC; **Içel:** Aslanlı env., Göktepe Dagi, 10.-12.vii.1998, 1 ♀, Büyükeçeli (Ovaçık) env., 70 m, 14.-18.vii.1998, 4 ♂♂, 2 ♀♀, M. Říha leg., MRBC; **Kayseri:** Kapuzbaşı env., 800 m, 16.vii.2003, 1 ♂, Çamlıca 5 km SW, Kayseri 120 km S, 1700 m, 18.vii.2003, 1 ♀, Hisarcık 1 km S, Kayseri 10 km S, 1660 m, 19.-20.vii.2003, 4 ♂♂, 1 ♀, P. Janšta and J. Straka leg., Develi 7 km NW, 1600 m, 23-24.vii.2003, 5 ♂♂, J. Straka leg., JSPC; **Kütahya:** Kütahya 30 km N, 13.vi.2000, 1 ♂, M. Halada leg., OLML.

GEOGRAPHIC DISTRIBUTION. South and Southeastern Europe north to Slovakia, North Africa; Turkey and Jordan to Central Asia and Afghanistan.

COMMENTS. A common species.

***Tachysphex liriformis* Pulawski, 1967**

Pulawski 1967: 395–396, fig. 18; 1971: 309–310, fig. 267; Hensen & Van Ooijen 1987: 12–13.

PUBLISHED RECORDS. **Içel:** Mut, 9.-13.vi.1965, 7 ♂♂, 15 ♀♀, J. Gusenleitner and M. Schwarz leg. (Pulawski 1967, 1971); **Urfa:** Urfa, without details (Pulawski 1971); **Bitlis:** Van, 13.-14.1977, 1 ♀, J. Timmer leg., as *Tachysphex* cf. *liriformis* (Hensen & Van Ooijen 1987).

MATERIAL EXAMINED. **Eskişehir:** Sakariilica naer Gümele, Eskişehir 30 km N, 6.-9.vii.1997, 1 ♂, P. Průdek and M. Říha leg., JSPC; **Kayseri:** Ulupinar 12 km N, Kayseri 140 km S, 1300 m, 17.vii.2003, 4 ♂♂, P. Janšta and J. Straka leg., JSPC.

GEOGRAPHIC DISTRIBUTION. Turkey to Israel, Turkmenistan and Tajikistan.

***Tachysphex mocsaryi* Kohl, 1884**

Pulawski 1967: 394; 1971: 312–315, fig. 269.

PUBLISHED RECORDS. **Kayseri:** Sultanhanı, 1200 m, 13.vi.1962, 3 ♂♂, K. M. Guichard and D. H. Harvey leg. (Pulawski 1967, 1971).

MATERIAL EXAMINED. **Adıyaman:** Nemrut dag, 13.vii.1996, 3 ♂♂, P. Tyrner and J. Voříšek leg., PTLC.

GEOGRAPHIC DISTRIBUTION. Spain, Southeast Europe north to Slovakia, Near East to Central Asia and Afghanistan.

***Tachysphex panzeri* (vander Linden, 1829)**

Pulawski 1967: 393; 1971: 262–270, figs 211–221.

PUBLISHED RECORDS. **Amasya, Ankara, Antalya, Hatay, İçel, Konya, Tokat, Tekirdag** (Pulawski 1967, 1971).

MATERIAL EXAMINED. **Adıyaman**: Nemrut dag, 13.vii.1996, 1 ♀, P. Tyrner and J. Voříšek leg., PTLC; **Antalya**: Gebiz env., 8.vii.2000, 1 ♂, J. Straka leg., JSPC, Side env., Antalya 70 km E, 29.vii.-7.viii.2001, 1 ♂, P. Tyrner leg., PTLC; **Bitlis**: Ahlat env., 14.vii.1996, 1 ♂, P. Tyrner and J. Voříšek leg., PTLC; **Bursa**: Çaglıyan env., 20.-23.vii.1998, 1 ♂, M. Řiha leg., MRBC; **Nevşehir**: Ürgüp, 4.vii.1997, 1 ♂, M. Halada leg., OLML; **Nigde**: Çamardı, 13.vii.1997, 1 ♂, M. Halada leg., OLML.

GEOGRAPHIC DISTRIBUTION. Europe except the North and British Isles, North Africa and Canary Islands, Asia east to Kazakhstan and Sri Lanka, also Thailand.

COMMENTS. A common species. This very variable species may consist of several sibling species. Only the typical and dark forms occur in Turkey.

Tachysphex persa persa Gussakovskij, 1933

as *T. aff. catharinae* Pulawski, 1964. Pulawski 1967: 397.

as *T. persa* Gussakovskij, 1933. Pulawski 1971: 328–331; Hensen & Van Ooijen 1987: 14.

PUBLISHED RECORDS. **Ankara**: Tuz Gölü lake, E side, Ankara 70 km S, 900 m, 1.ix.1959, 1 ♀, K. M. Guichard and D. H. Harvey leg.; Erzurum: Kandilli, 1900 m, 11.vi.1962, 1 ♂, K. M. Guichard and D. H. Harvey leg.; **Kayseri**: Sultanhanı, 1200 m, 13.vi.1962, 3 ♀♀, K. M. Guichard and D. H. Harvey leg. (Pulawski 1967, 1971); **Içel**: Mut, **Urfa**: Urfa, Birecik, without details (Pulawski 1971); **Burdur**: Çeltikçi, 2.ix.1983, 1 ♀, P. D. J. Van Ooijen leg. (Hensen & Van Ooijen 1987).

GEOGRAPHIC DISTRIBUTION. Turkey, Syria, Lebanon, Israel, Egypt, Armenia and Iran.

Tachysphex persa nigripes Pulawski, 1967

Pulawski 1971: 332–333, fig. 282.

as *T. nigripes* Pulawski 1967. Pulawski 1967: 397, fig. 19.

PUBLISHED RECORDS. **Içel**: Mut, 9.vi.1965, 1 ♀, M. Schwarz leg., Tarsus, 29.-31.v.1965, 3 ♂♂, 3 ♀♀, J. Gusenleitner and M. Schwarz leg. (Pulawski 1967, 1971); **Konya**: Sille, without details (Pulawski 1971);

MATERIAL EXAMINED. **Kayseri**: Çamlıca 5 km SW, Kayseri 120 km S, 1700 m, 18.vii.2003, 5 ♂♂, P. Janšta and J. Straka leg., JSPC; **Kütahya**: Kütahya 30 km N, 13.vi.2000, 1 ♂, M. Hlada leg., OLML.

GEOGRAPHIC DISTRIBUTION. Bulgaria and Greece to Central Asia.

Tachysphex pulcher Pulawski, 1967

Pulawski 1967: 394–395; 1971: 280–282; Hensen & Van Ooijen 1987: 16.

PUBLISHED RECORDS. **Ankara**: Tuz Gölü lake, 900 m, 1.ix.1959, 1 ♀, K. M. Guichard leg. (Pulawski 1967, 1971); **Konya**: Konya, without details (Pulawski 1971); **AGRI**: Dogubayazit, 20.viii.1983, 1 ♂, 1 ♀, P. D. J. Van Ooijen leg.; **Bingöl**: Genç 15 km S, 1400 m, 13.viii.1985, R. Hensen leg., sex and number of specimens missing (Hensen & Van Ooijen 1987).

MATERIAL EXAMINED. **Adıyaman**: Nemrut dag, 2000 m, 16.viii.1991, 1 ♂, M. Halada leg., OLML; **VAN**: Erciş 10 km E, 25.vi.1997, 1 ♀, Muradiye 10 km N, 27.vi.1997, 1 ♂, M. Halada leg., OLML; “Tshajan” (not located), 26.vii.1906, 1 ♂, Lendl leg., HNHM.

GEOGRAPHIC DISTRIBUTION. Turkey and Israel to Central Asia.

Tachysphex tessellatus (Dahlbom, 1845)

Pulawski 1967: 393; 1971: 276–278, fig. 222.

PUBLISHED RECORDS. **Adana**: Karataş, 8.vi.1960, 1 ♂, K. M. Guichard and D. H. Harvey leg.; **Hatay**: Antakya, 1.-7.vi.1965, 1 ♂, J. Gusenleitner and M. Schwarz leg.; **Içel**: Alata, 30.v.1960, 1 ♀, K. M. Guichard and D. H. Harvey

leg.; **Samsun**: Samsun, 0–30 m, 2.viii.1959, 1 ♀, K. M. Guichard and D. H. Harvey leg.; **Iğdir**: Ararat Mt., below Serdarbulak, 1700 m, 4.ix.1960, 2 ♂♂, K. M. Guichard and D. H. Harvey leg. (Pulawski 1967, 1971). MATERIAL EXAMINED. **Siirt**: Siirt 15 km S, 500 m, 13.viii.1991, 1 ♂, M. Halada leg., OLML.

GEOGRAPHIC DISTRIBUTION. Greece and Turkey.

Tachysphex julliani species group

Tachysphex argentatus Gussakovskij, 1952

Pulawski 1967: 398; 1971: 369–372, figs 325–327.

PUBLISHED RECORDS. **Ankara**: Kalecik, banks of the river Kizilirmak, 900 m, 7.viii.1960, 5 ♀♀ (Pulawski 1967, 1971); **Içel**: Mut, without details (Pulawski 1971).

MATERIAL EXAMINED. **Batman**: Kozluk, 3.vi.1998, 1 ♂, M. Halada leg., OLML.

GEOGRAPHIC DISTRIBUTION. Turkey and Egypt to Central Asia.

Tachysphex dignus Kohl, 1889

Pulawski 1967: 398–400, figs 20–21; 1971: 357–360, figs 309–314.

PUBLISHED RECORDS. **Ankara**: Beynam, 1000 m, 26.vi.1962, 1 ♂, Kirikkale 16 km W, 29.vi.1960, 1 ♀, K. M. Guichard and D. H. Harvey leg.; **Erzincan**: Rafahiye – Erzincan road, 1000 m, 10.vii.1960, 3 ♂♂, K. M. Guichard and D. H. Harvey leg.; **Kirikkale**: Kirikkale 13 km W, 900 m, 30.vi.1960, 2 ♀♀, K. M. Guichard and D. H. Harvey leg.; **Kirşehir**: Kaman env., 1000 m, 17.vi.1962, 5 ♂♂, K. M. Guichard and D. H. Harvey leg.; **Içel**: Mut, 9.–13.vi.1965, 2 ♀♀, J. Gusenleitner and M. Schwarz leg. (Pulawski 1967); **Içel**: Tarsus, **Konya**: Sille, without details (Pulawski 1971).

MATERIAL EXAMINED. **Adana**: Boztahta 1 km W, Adana 45 km N, 330 m, 24.vi.2001, 3 ♂♂, M. Fikáček, J. Hájek and J. Straka leg., JSPC; **Adıyaman**: Nemrut dag, 2500 m, 13.vii.1996, 5 ♂♂, 2 ♀♀, P. Tyrner and J. Voříšek leg., PTLC; **Eskişehir**: Sakariilica naer Gümele, Eskişehir 30 km N, 6.–9.vii.1997, 1 ♂, P. Průdek and M. Říha leg., MRBC.

GEOGRAPHIC DISTRIBUTION. Cyprus; Israel and Turkey to southern parts of Central Asia.

Tachysphex julliani Kohl, 1883

Pulawski 1967: 398; 1971: 360–365, figs 315–320.

PUBLISHED RECORDS. **Ankara**: Kalecik env., 900 m, 7.viii.1960, 2 ♀♀, K. M. Guichard and D. H. Harvey leg.; **Hatay**: Antakya, 1.–7.vi.1965, 4 ♂♂, J. Gusenleitner and M. Schwarz leg.; **Içel**: Mut, 9.–13.vi.1965, 1 ♂, Tarsus, 29.–31.v.1965, 14 ♂♂, 1 ♀, J. Gusenleitner and M. Schwarz leg. (Pulawski 1967, 1971).

MATERIAL EXAMINED. **Antalya**: Beşkonak env., 300 m, 18.vi.2001, 1 ♂, M. Fikáček, J. Hájek and J. Straka leg., JSPC; **Kayseri**: Ulupinar 8 km N, Kayseri 140 km S, 1100 m, 17.vii.2003, 4 ♂♂, Develi 7 km NW, 1600 m, 24.vii.2003, 2 ♂♂, J. Straka leg., JSPC; **Nevşehir**: Ürgüp, 4.vii.1997, 1 ♀, M. Halada leg., OLML; **Nigde**: Çamardi, 13.vii.1997, 1 ♀, M. Halada leg., OLML.

GEOGRAPHIC DISTRIBUTION. North Africa (ssp. *africanus* Pulawski, 1971), Southern Europe and Near East to southern parts of Central Asia.

Tachysphex schmiedeknechti Kohl, 1883

Pulawski 1967: 398; 1971: 389–393, figs 358–366.

PUBLISHED RECORDS. **Içel**: Alata, 1960 m, 29.v.1960, 4 ♂♂, 30.v.1960, 1 ♂, K. M. Guichard and D. H. Harvey leg. (Pulawski 1967, 1971).

MATERIAL EXAMINED. **Antalya**: Beşkonak env., 300 m, 18.vi.2001, 1 ♀, M. Fikáček, J. Hájek and J. Straka leg., JSPC.

GEOGRAPHIC DISTRIBUTION. North Africa south to Ghana and Togo, Spain, Greece, Cyprus, Turkey, Syria, Iran, Yemen, Central Asia and Northwest India.

COMMENTS. The form of the male volsella indicates a close relationship to the *Tachysphex julliani* species group.

Tachysphex vulneratus R. Turner, 1917

MATERIAL EXAMINED. **Içel**: Büyükeçeli (Ovaçık) env., 70 m, 14.-18.vii.1998, 1 ♂, M. Řiha leg., JSPC.

GEOGRAPHIC DISTRIBUTION. Sub-Saharan Africa, Northeastern Chad, Algeria, India and Thailand.

COMMENTS. From North Africa only one male is known – the holotype of *T. foucauldi* de Beaumont, 1952 from Algeria (Krombein & Pulawski 1994). New species for Turkey.

Tachysphex erythropus species group

Tachysphex costae (De Stefani, 1882)

Pulawski 1967: 397; 1971: 400–406, figs 371–380.

PUBLISHED RECORDS. **Ankara**: Ankara 70 km S, Şereflikoçhisar 20 km N, 900 m, 24.vi.1962, 3 ♂♂, K. M. Guichard and D. H. Harvey leg. (Pulawski 1967, 1971); **Içel**: Mut, **Izmir**: Ephesus, **Tekirdag**: Tekirdag, without details (Pulawski 1971).

MATERIAL EXAMINED. **Kayseri**: Hisarcik 1 km S, Kayseri 10 km S, 1660 m, 20.vii.2003, 1 ♂, P. Janšta and J. Straka leg., JSPC.

GEOGRAPHIC DISTRIBUTION. Southern Europe, North Africa; Israel and Turkey to Central Asia.

Tachysphex erythropus (Spinola, 1838)

Pulawski 1967: 397; 1971: 408–411, figs 381–383.

PUBLISHED RECORDS. **Içel**: Mut, 9.-13.vi.1965, 3 ♂♂, 1 ♀, J. Gusenleitner and M. Schwarz leg. (Pulawski 1967, 1971); **Aydin**: Kuşadası, Ortaklar, without details (Pulawski 1971).

MATERIAL EXAMINED. **Adana**: Karataş 5-8 km W, Adana 48 km S, 10 m, 14.vii.2003, 2 ♂♂, 1 ♀, P. Janšta and J. Straka leg., JSPC; **Bursa**: Çaglıyan env., 20.-23.vii.1998, 1 ♂, M. Řiha leg., JSPC.

GEOGRAPHIC DISTRIBUTION. North Africa to Sudan, Ethiopia and Kenya, Iberian Peninsula, south-eastern Europe, Turkey, Israel, Arabian Peninsula, Azerbaijan, Central Asia, Iran and Gujarat in India.

Tachysphex selectus Nurse, 1909

T. actaeon de Beaumont, 1960. Pulawski 1967: 398; 1971: 412–414, figs 384–385, synonymized by Pulawski in Krombein & Pulawski (1994).

PUBLISHED RECORDS. **Kahraman Maras**: Kahramanmaraş – Gaziantep road, 100 m, 18.vi.1960, 1 ♂, K. M. Guichard and D. H. Harvey leg. (Pulawski 1967, 1971); **Urfa**, without details (Pulawski 1971).

MATERIAL EXAMINED. **Antalya**: Kemer env., Antalya 35 km SW, 16.-18.vii.2002, 1 ♂, Göynük env., Antalya 25 km SW, 18.-20.vii.2002, 4 ♂♂, P. Tyrner leg., PTLC; **Balikesir**: Ar Kent, Ayvalik env., 28.vi.-10.vii.1993, 5 ♂♂, P. Tyrner leg., PTLC, JSPC.

GEOGRAPHIC DISTRIBUTION. Turkey, Cyprus, Israel, Lebanon, Pakistan, India and Sri Lanka.

Tachysphex sordidus (Dahlbom, 1845)

Pulawski 1971: 417–420, figs 387–391.

PUBLISHED RECORDS. **Içel**: Mut, without details (Pulawski 1971).

MATERIAL EXAMINED. **Antalya**: Göynük env., Antalya 25 km SW, 18.-20.vii.2002, 3 ♂♂, 1 ♀, P. Tyrner leg., PTLC, JSPC; **Nevşehir**: Ürgüp, 1100 m, 24.viii.1991, 1 ♀, M. Halada leg., OLML.

GEOGRAPHIC DISTRIBUTION. Rhodos, Cyprus and Turkey to Central Asia.

Tachysphex albocinctus species group

Tachysphex albocinctus (Lucas, 1848)

MATERIAL EXAMINED. **Adana**: Çiçekli, Adana 25 km N, 3.-5.vii.1998, 3 ♂♂, 2 ♀♀, M. Říha leg., JSPC, MRBC, Karataş 5-8 km W, Adana 48 km S, 10 m, 14.vii.2003, 1 ♂, 3 ♀♀, P. Janšta and J. Straka leg., JSPC; **Antalya**: Göynük env., Antalya 25 km SW, 18.-20.vii.2002, 1 ♂, P. Tyrner leg., PTLC.

GEOGRAPHIC DISTRIBUTION. Africa, southern Iberian Peninsula, Crete and Near East to southern parts of Central Asia.

COMMENTS. New species for Turkey.

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